ELECTRICAL REVIEW

Vol. CXLIX 16th NOVEMBER, 1951 No. 3860

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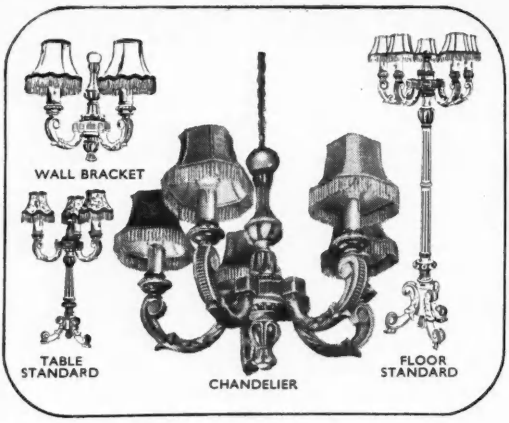
EDITORIAL, ADVERTISING & PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home and Overseas £3 6s 0d: U.S.A. and Canada $11.00. Cheques & P.Os. (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD. and crossed "Lloyds Bank."



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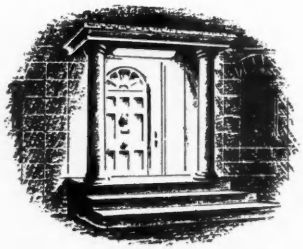

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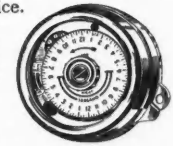

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ELECTRICAL REVIEW

Vol. CXLIX No. 3860 16TH NOVEMBER, 1951

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

Oil Production

SOME ELECTRICAL ASPECTS

THERE have been coal mines in Britain for three hundred years whereas the modern petroleum industry began one hundred years ago, when a Scottish chemist succeeded in getting wax and kerosene as well as lubricants from natural oil which flowed into the workings of a Derbyshire coal mine. He later developed similar means of treating shales in Scotland.

Cost of Drilling

It is just ninety years since the first oil well was drilled; oil was struck at 69ft while the deepest boring in 1949 reached 20,521ft and 15,530ft is the deepest developed source. The cost of drilling may exceed £250,000 for a deep exploratory well and of the 42,000 wells completed in 1949 no fewer than 13,000 were dry! The figure was only four out of 89 in the Middle East oilfields, which have lately been furnishing most of the crude oil and three-quarters of all the oil needed in Western Europe.

One of the largest refineries is at the head of the Persian Gulf and the largest pipeline—there are 150,000 miles of oil pipelines in the United States—was completed last year. It is of 30 to 31in diameter and 1,100 miles long, designed to carry as much oil as 60 sea-going tankers, each of 16,000 tons, making the 7,000 miles round voyage between the Persian Gulf and the Mediterranean.

Nearly one-fifth of the world's merchant shipping is made up of tankers, the construction of which has been an outstanding feature of post-war shipbuilding. The deadweight tanker tonnage increased by 1¼ million during the first half of this year to a total of 28½ million and last spring one company ordered 46 ships. Four of them are to be steam turbo-electrically propelled and there is reason to suppose that if there had been a free choice the owners would have liked all but the five largest to be electrically driven. Incidentally, a tanker recently set out to cross the Atlantic with a gas turbo-alternator substituted for one of its four diesel-electric sets.

Large-scale Electrical Requirements

The oil industry spent £50 million in 1950 on goods of British make. The scale of operations may be judged perhaps from the fact that in one of the newer refineries in this country one manufacturing firm alone has installed 14,000 h.p. of motors as well as forty switchboards and much other gear.

The entire installation is of flameproof design. It has emphasized the difference between American and British ideas of enclosure and installation

practice. It has also disclosed the disparity between the comprehensiveness of specialized equipment of this kind in the United States and our own relatively limited range. But British electrical manufacturers, within the limitations imposed by Buxton requirements, have met the many demands made upon them for the modification of stock items and have shown initiative in the development of new equipment to satisfy the needs of the petroleum industry generally.

APPLIANCE TESTING

Mr. W. R. T. Skinner, deputy chairman of the South Eastern Electricity Board, at a meeting last week, expressed the view that a number of separate establishments for testing and approving electrical appliances was preferable to a central testing house. His idea was that whereas the rejection of an appliance by a central body was absolute there might not be total rejection by a number of testing houses. While that might prove true, the position would not be very satisfactory to manufacturers. Even if an appliance were approved by several Boards, rejection by another would inflict a stigma sufficient to neutralize any benefits derived from approval. Also, uncertainty would be created, even in the minds of officials of the approving Boards. It is much better to have a single standard of acceptance than a conflict of opinions in a matter of this kind.

MAINTENANCE CONTRACTS

Complaints that the amounts required by the South East Scotland Electricity Board under annual contracts for the maintenance of domestic electrical appliances were too high have been refuted by the Board. A member of the Consultative Council has said that the charge in respect of an electric cooker, washing machine, kettle and immersion heater would be 61s a year. It is rightly pointed out that the consumers are under no obligation to place maintenance contracts with the Board. The probability is that consumers with ageing appliances will form the majority of those taking advantage of the scheme and this will naturally involve costs at a high level. Moreover this makes it unlikely that increasing numbers will reduce average costs; indeed the opposite will probably be experienced.

WATER MAIN EARTHING

For power stations sited in populated areas. public water mains have hitherto usually provided lower resistances for earthing than are obtainable with local electrodes. In an article in this issue it is pointed out that for modern large stations an electrode resistance of even one ohm may result in high voltages to earth under fault conditions. In our last issue Mr. T. C. Gilbert showed that many times that ohmic value is found where non-metallic pipes have been inserted in some water supply systems, as appears to be the tendency. The many conducting paths offered by a widely spread water supply network are its important earthing feature and, apart from the problem raised by breaks in electrical conductivity, many new stations are remote from such water systems.

LONDON'S ELECTRICITY

The case for the unification of London's electricity supply before nationalization was strong. In the late 'thirties the amalgamation of the Central London companies reduced the bewildering array of undertakings, but there remained forty separate systems at vesting day. Some of the results achieved since then were mentioned by Mr. H. J. Randall, chairman of the London Electricity Board, last week, notably that the average price per kWh in the Area was less now than three years ago. This, against a background of steeply rising costs, is sufficient to indicate the truth of the statement that economies and improvements have been achieved which would not otherwise have been possible.

AMERICAN SETBACKS

We have pointed out previously that handicaps to the expansion of generating capacity are not peculiar to Great Britain; even the United States is similarly affected. The *Electrical World* (New York) says that "maladjustments" in the production of equipment, including boiler tubes (one major trouble here), along with material shortages, have reduced new capacity for 1951 by about 1,000 MW. Inadequate supplies of structural steel are expected to result in a loss of between 2,000 and 3,000 MW in 1952. Nevertheless it is still expected that 7,500 MW will be added next year—as compared with a hoped-for maximum of 1,400 MW in this country.

Naval Gas Turbine

Admiralty Contract Fulfilled at Bedford

FOUR years ago a development contract was placed by the Admiralty with W. H. Allen, Sons & Co., Ltd., Bedford, for the construction, to a clearly defined naval specification, of a gas turbo-alternator for base load operation.

A section of the Biddenham works was set aside for gas-turbine assembly and the installation of special machine tools needed for blade manufacture, while a fully equipped test house was built on behalf of the Admiralty.

The set, which was successfully run at full speed and full power early this year, is of relatively simple open-cycle type (see table) having an axial-flow compressor of $4\frac{1}{4}$: 1 ratio driven by a two-stage turbine, an annular two-pass cross-flow heat exchanger, a multi-chamber combustion system symmetrically disposed around the machine and a separate single-stage power turbine driving an Allen alternator through Allen-Stoeckicht epicyclic gearing.

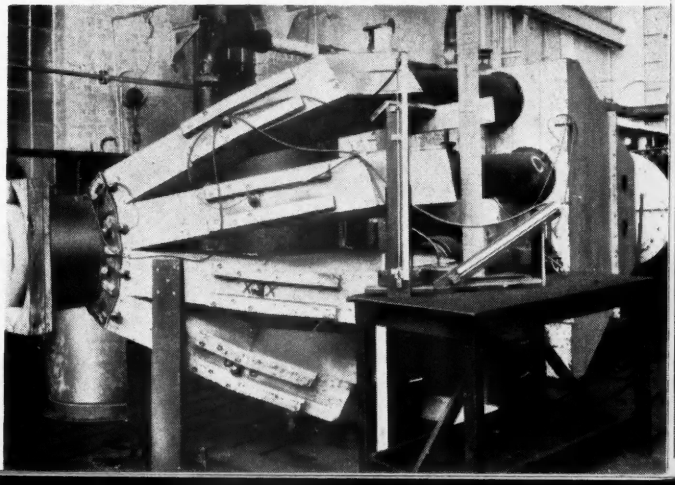
The set is within the stipulated height of 7 ft, is 16 ft long and 8ft 6in wide; its total weight (including the heat exchanger, but excluding the alternator) is $8\frac{1}{2}$ tons. The machine is without any baseplate; three-point mounting on rubber (imparting resiliency to minimize shock in the event of underwater explosions) has been effected by mounting the compressor separately. The supports on each side of the heat exchanger are flexible to allow for thermal expansion.

The Admiralty specified a capacity of 1,000 kW (m.c.r.) with ability to carry 20 per cent overload for ten minutes, for operation at all loads up to overload in temperate (60 deg F) or tropical (100 deg F) temperatures and in parallel with steam turbo-alternators. The governing requirements were $2\frac{1}{2}$ per cent speed

BASIC DESIGN PARTICULARS

M.c.r. at power turbine coupling, including fouling margin	1,512 b.h.p.
Est. specific fuel cons. at m.c.r...	0.745 lb/b.h.p.-hr
Est. thermal eff. at power turbine coupling at m.c.r.	19.75 per cent
Mass flow at m.c.r.	37 lb/sec
Max. gas temp. tropical	700 deg C
Max. gas temp. temperate	650 deg C
Compressor speed	8,000 r.p.m.
No. of compressor stages	13
No. of comp. turbine stages....	2
Est. comp. adiabatic eff.	84 per cent
Est. comp. turbine adiabatic eff.	85 per cent
Power turbine speed	6,750 r.p.m.
No. of power turbine stages....	1
Est. power turbine adiabatic eff.	84 per cent
Alternator speed	1,500 r.p.m.
Type of combustion chambers..	Straight through
No. of combustion chambers ..	8
Type of burner	"Simplex"
No. of heat exchanger passes:	
Hot gas	1
Cold air	2
Heat exchanger thermal ratio ..	70 per cent

NOTE.—The output stated is that obtained with the high inlet and exhaust losses specified. Without these abnormal losses the m.c.r. electrical output would be 1,250 kW (temperate conditions) while the thermal efficiency would be 24 per cent and the specific fuel consumption 0.625 lb/b.h.p.-hr.



Model of compressor discharge and associated apparatus as assembled for aerodynamic tests

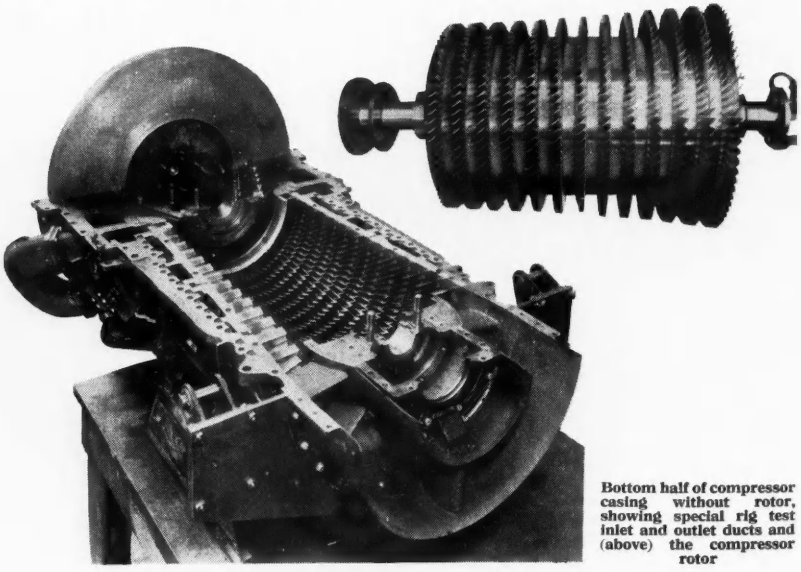
change for 50 per cent change of load and ability to accept or shed 100 per cent load without the emergency gear tripping.

A maximum consumption of fuel (Admiralty B.310 diesel oil) of 1·27 lb/kWh under tropical conditions in the 60 to 100 per cent power zone was specified. Total head pressures of 14·1 lb/sq in (abs.) at the compressor intake and 15·1 lb/sq in (abs.) at the power turbine exhaust allow for very high trunking losses. A life of 100,000 hours has been aimed at, made up of 65,000 hours at 80 per cent power under temperate conditions with 33,000 hours at 80 per cent power and 2,000 hours at full power under tropical conditions.

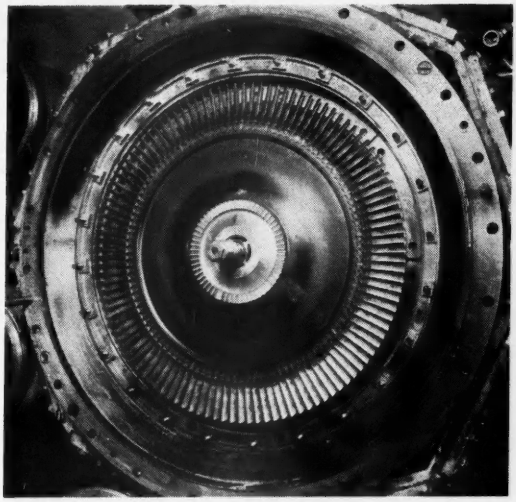
The mechanical design is such that each assembly is removable from the machine independently of the others. The compressor casing is split horizontally, the top half being removable for inspection without breaking any pipe joints. The centre bearing can be inspected by dismantling those air pipes which are connected to the top half of the casing and removing the latter, which is also split horizontally. The two turbines can be inspected, after removal of the compressor air delivery pipes and the combustion chambers, by splitting the casing vertically between the compressor and power turbines and moving the compressor, with its associated turbine, away bodily, while an overhead crane supports its weight. Either the power turbine or the compressor turbine assembly can be removed endwise as a unit for further dismantling. The gear case is split horizontally and the epicyclic gear assembly can be removed vertically.

The multi-stage compressor rotor is of a special built-up design to reduce its moment of inertia to assist the speed governor during sudden large load changes. The inlet end of the shaft is manufactured from 1 per cent chrome molybdenum steel and the outlet end of " Nitralloy " steel, hardened at the bearing journals. The rotor wheels are of 1 per cent chrome molybdenum steel (B.S. En. 19) and the discs are secured to each other on the faces of the bosses by dowel pins, through which the torque is transmitted. The complete rotor disc assembly and the shaft ends are clamped together by a steel bolt through the centrally bored discs, which allows for thermal expansion. Concentricity is maintained between the compressor disc assembly and the two stub shafts by butting them together on the faces with " Hirth " couplings.

Each of the rotor blades, of aerofoil section, is machined integrally with its root from 13 per cent chrome stainless iron bar.



Bottom half of compressor casing without rotor, showing special rig test inlet and outlet ducts and (above) the compressor rotor



The compressor turbine—second-stage rotor, looking upstream after initial running tests

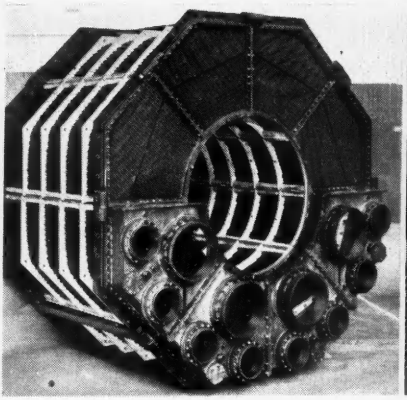
They are wired together in groups of ten for ease of assembly and are lightly positioned between the rims of adjacent wheels by means of a groove machined in the roots, which engages with a corresponding register on the discs. The discs and blades were assembled with the axis of the rotor vertical. The blade profiles were machined by Centrax, Ltd. The stator blades are of rolled monel strip, also of aerofoil section, cast into combined roots and spacers and secured in grooves in the cast steel casing which is of double-skin construction to ensure sufficient space for air blow-off, but this has since been found unnecessary.

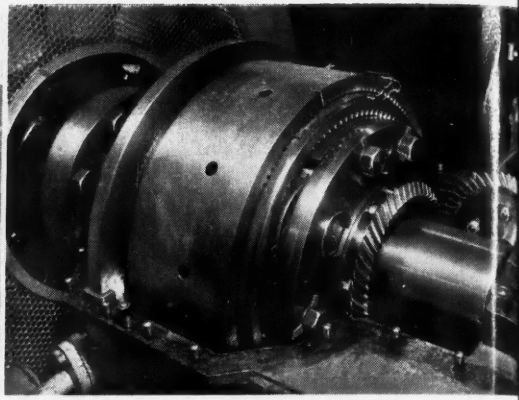
The heat exchanger is of the tubular, cross-flow, recuperative type with a single pass on the hot exhaust gas side and two passes on the cold inlet air side. It is built of eight similar segments, each containing just over 2,000 tubes, a total of 16,500. The shell is of fabricated aluminized mild steel fitted with the Yorkshire Copper Co.'s " Yorcalnic " tubes, $\frac{1}{8}$in outside diameter and 0·020in thick. The tubes are secured to the mild steel tube plates by ferrules expanded by a hydraulically-operated riveting gun made by Aviation Development, Ltd. The ferrules are threaded on to a mandrel which is loaded into the riveting gun. The first ferrule and the mandrel are entered into the tube and when the gun is fired the mandrel is drawn back through the ferrule, so expanding it and the tube into the tube plate; the inside diameter of the ferrule is the same after expanding as that of the tube bore. This method of tube assembly is both satisfactory and extremely rapid.

Eight combustion chambers are disposed symmetrically about the axial centre-line of the turbine shaft. They were designed and made by Joseph Lucas, Ltd. The inner flame tubes are of " Nimonic 75 " nickel-chrome alloy, cooled by the secondary air. The outer air casing is of aluminized mild steel sheet and is fitted with two bellows pieces to take up the differential expansion between the turbine casing and the heat exchanger. Each end of the combustion chambers is secured by a quick-release joint.

The compressor turbine is of the two-stage axial-flow type. The two " G.18B " steel rotor wheels and the stub shafts are screwed together by a pre-stressed manganese molybdenum bolt passing through the centrally-bored wheels, designed to withstand the large expansion of the wheels themselves, while " Hirth " couplings again position the wheels and the " Nitralloy " steel stub shaft; the latter is hardened on the bearing journals.

The rotor blades were manufactured by the " plunge grinding " process patented by the Bristol Aeroplane Co. and are of " Nimonic 80.A," secured in axial fir-tree type serrations in the periphery of the wheels, each blade being fixed by a locking key. All stator blades are of " Nimonic 80 " cast by the lost wax process. The first-stage blades are riveted in groups to segmented strips to form assemblies easy to handle. Each second-stage blade is secured in a groove in the intermediate casing ring and held circumferentially by two pegs. The inner end of each blade has a cylindrical projection which fits into a radial hole in the diaphragm. This engagement is such that the stator blade is free to expand





The heat exchanger with top four air headers removed to show build-up of the eight similar segments. Right: The double-helical epicyclic speed-reducing gear (top cover removed) between the power turbine and alternator, also showing bevel-gear drive to governor and tachometer

radially towards the centre of the diaphragm and the latter to expand radially outwards.

The diaphragm is protected by heat shields designed to prevent temperature gradient distortion. The casing consists of an inner and outer member designed to minimize thermal expansion stresses and to allow all parts to expand freely and yet remain concentric. A centre casing ring of heat-resisting material is so held in the main casing by radial keys that it is free to expand radially at all points on its circumference. Inner segmented shroud rings of " H.R. Crown Max " steel are arranged to expand circumferentially in grooves in this casing ring. This arrangement maintains the blade tip clearances at all loads, thus improving the efficiency and also making it quite safe to shut down and start up quickly. Cooling air from the compressor passes around the inner casing and through passages in the centre casing ring before joining the main gas stream.

The coupled compressor and driving turbine shafts are supported in three bearings. Allowance for any misalignment of the shafts is made by connecting them by means of a quill shaft forming an extension of the turbine shaft in the bore of the compressor shaft. The driving torque is, however, transmitted through a normal gear-tooth type muff coupling.

The power turbine is of the axial-flow type, mechanically independent of the compressor turbine. The materials and general construction are similar to those already described, with the exception that the rotor wheel is of Jessop's " H.40 " ferritic steel. The bearing is connected radially to the outer main casing by four radial fabricated struts passing through stream-line aerofoils, which are themselves integral with the mild-steel power turbine exhaust diffuser ducting assembly.

The cooling of the rotors and casing is by several systems so arranged that air from the compressor delivery flows through passages in the turbine casings and up both sides of the turbine rotor discs, finally joining the main gas stream.

All main bearings are of the sleeve type, following steam turbine practice. They are of steel lined with white metal, the exceptions being those that may be subjected to higher temperatures, which are of mild steel lined with lead bronze. They are lubricated and cooled by oil at a pressure of approx. 10 lb/sq in; ball and roller bearings are incorporated in the auxiliary drives and the thrust bearings are of the Michell type; journal bearings are fitted with thermocouples and the thrust bearings with hydraulic wear gauges.

The casing and interstage glands are labyrinths formed by stationary stainless-iron fins working in conjunction with stepped shaft journals. The turbines are attached to their driving shafts by continuously-lubricated internal tooth-type couplings; oil is centrifugally forced through

internal passages to each tooth engagement. Speed reduction gearing between power turbine and alternator is designed on the Stoeckicht principle (which ensures equal load sharing, not only between the planet wheels, but also between the helices) and is capable of transmitting 1,800 h.p. continuously from a turbine speed of 6,750 r.p.m. to an alternator speed of 1,500 r.p.m. There are no high-speed shaft bearings in the gear unit, the sun wheel (supported between the three planet wheels) being connected to the power turbine by a double-helical-tooth flexible coupling.

The open, self-ventilated, rotating-field, salient-pole alternator is continuously rated at 1,000 kW, 0·8 power factor, 50 c/s, 3-phase, 400/430 V when driven at 1,500 r.p.m. The stator windings are of high-conductivity copper, insulated with moulded micanite, and are held in position by synthetic-resin-bonded-fabric wedges. The rotating-field windings are of extremely robust strip-on-edge construction. The rotor poles are secured to a steel shaft, carried in a single split-sleeve pedestal bearing, rigidly coupled to the gearwheel shaft. The bearing is pressure lubricated with oil from the turbine lubrication system.

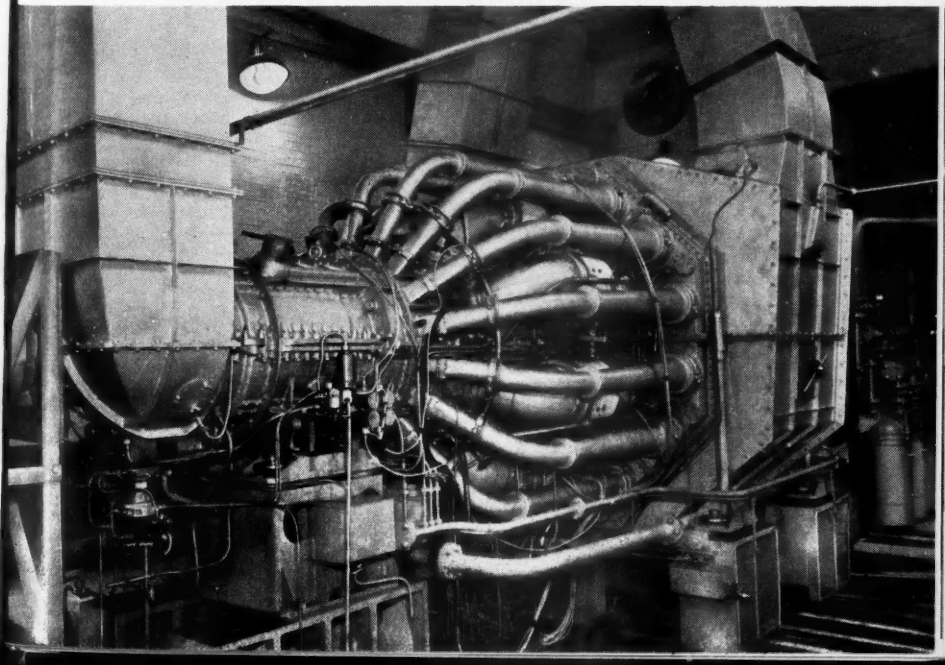
A carbon-pile voltage regulator is connected in the exciter-field circuit; to quicken the voltage response a permanent-magnet pilot exciter is employed (belt-driven from the main exciter), avoiding the necessity for a small commutator and brush gear. It comprises a 4-pole permanent-magnet rotor in a normal stator frame, the output from which energizes the field of the main exciter through a metal-oxide rectifier situated in the air stream of the main exciter at the bottom of the commutator end bracket. The two-bearing exciter is flexibly coupled to the rotor shaft, and is provided with a shunt field regulator.

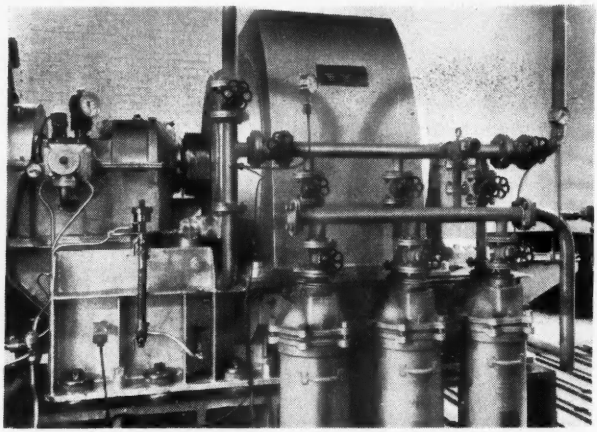
Lubrication follows closely usual steam turbine practice. One of two separate valveless gear-type pumps delivers at 120 lb/sq in to the governor oil system, while the other delivers at 45 lb/sq in to bearings and gear-teeth.

The pumps are driven in tandem by an electric motor when starting and by the turbine shaft through gearing during normal running. A clutch permits automatic transfer when the turbine has reached a speed sufficient to maintain the pressure in the oil system. Oil for the governor pump is taken from the lubricating system so that the oil for both systems passes through a filter and cooler.

The fuel-oil system employs Lucas

The set as erected for testing at Bedford, lagged outer covers removed to expose compressor, turbines, air pipes, heat exchanger, combustion chambers and instrumentation piping with air intake trunking shown on the left and exhaust outlets on each side of the heat exchanger





Close-up view of epicyclic gear between the power turbine and alternator, the speed governor and tachometer, and lubricating-oil filters mounted at the side of the alternator

"Simplex" burners. The quantity delivered to the combustion chambers is varied by a throttle valve controlled by the speed governor through an oil relay. A hand-actuated throttle valve is used when starting. The fuel pump is the Lucas type "B," driven through gearing from the compressor shaft. An emergency shut-off valve in the fuel system will operate automatically in the event of the turbine overspeeding, or of failure of the lubricating-oil pressure; it is also arranged to close on manual operation of trip-cocks situated both on the turbine and on the control panel.

Four of the eight interconnectors fitted between the combustion chambers have igniter assemblies, each consisting of a thermocouple, a plug and a torch so that each chamber is ignited directly by a torch. In the event of one or more of the torches failing, the interconnectors will ensure ignition in all the chambers.

The centrifugal speed governor is driven from the power turbine shaft; it operates the fuel throttle valve through a high-pressure oil relay so arranged that in the event of failure of lubricating-oil flow the machine will automatically shut down. To assist the governor during sudden load changes a small flywheel is fitted on the high-speed shaft and housed in the reduction gear casing, while the compressor rotating assembly is specially designed to have a low moment of inertia. There is a regulating handwheel on the governor itself for adjusting the speed of the power turbine at no-load to within 5 per cent above or below the rated speed. A small electric motor is also embodied in the governor gear to enable the speed to be adjusted from both the switchboard and the control panel.

Overspeed trip governors of the shock-proof unbalanced-ring type are fitted to both the compressor and the power turbine shafts, arranged to operate an emergency shut-off fuel valve by destroying the pressure in the oil relay if the speed exceeds a predetermined amount. Hand trip-cocks are fitted both on the machine and on the control panel.

The starting procedure is to run the compressor by an electric motor up to 1,500 r.p.m. (taking approximately 16 h.p.). The torch igniters are then lighted by an ordinary sparking plug. When the thermocouples indicate that the igniters are operating satisfactorily the main fuel supply is admitted to the burners. Other thermocouples indicate when each combustion chamber is alight and upon

Gas turbine test house at the Allen Works, Bedford; main doors give access to the turbine test chamber, while the compartment on the right is the observation and instrumentation room

verification that all are functioning, the turbine is accelerated by the hand throttle valve. The starter motor continues to assist up to 2,500 r.p.m., when the turbine speed overtakes that of the starter motor, so causing disengagement of a free-wheel clutch. As the turbine approaches no-load speed the automatic governor takes over control of the fuel supply through the oil-operated throttle valve. This condition is reached in approximately one minute. Normally the turbine is run thus for five minutes for warming up before taking on load, but, if necessary, it is capable of taking full load in approximately one and a half minutes. Barring-over of the machine is not necessary after shutting down, but oil circulation to the bearings is continued for a few minutes.

The Bristol Aeroplane Co. carried out tests on the compressor and compressor turbine as separate independent units, which proved that the adiabatic compressor efficiency was 86 per cent, compared with the design figure of 84 per cent; also that the compressor turbine exactly achieved the design efficiency of 85 per cent at the designed point and exceeded that figure by 1 per cent at lower duties.

Pressure combustion tests carried out on the combustion chambers at the normal working pressure by Joseph Lucas, Ltd., proved the combustion efficiency to be slightly in excess of 98 per cent.

Aerodynamic tests were undertaken by Allens at their Bedford works on scale models of the compressor inlet and outlet ducting, the heat exchanger return header and the power turbine exhaust diffuser, to minimize the flow-path losses.

The set, without the heat exchanger, has been on test since early this year. Performance, governing and endurance tests are now proceeding.

Lighting Investigations

The Work of an Illuminating Laboratory

THE functions and equipment of an illuminating laboratory formed the subject of a paper presented by Mr. H. F. Stephenson to the Illuminating Engineering Society in London this week. The paper commenced by stressing the need for a proper understanding of the significance of photometric measurements and proceeded to review the basic equipment employed for this work. Factors which governed the choice of measuring methods were dealt with and the essential features of polar co-ordinate and turntable distribution photometers were discussed with the aid of typical examples.

Turning next to large sources at low mounting heights, such as fluorescent fittings, the purpose and preparation of equilux illumination diagrams were explained as well as a device for rotating a fitting to facilitate the preparation of these diagrams.

The relative merits of determining light output ratios by calculation or with the aid of a photometric integrator were discussed, showing that an integrator for modern fittings was apt to be very large and expensive, the author remarking that the considerable space it required could often be more usefully employed for other purposes.

The author next turned to the characteristics of photocell–galvanometer combinations used in light distribution photometry, mentioning the precautions necessary in their use and apparatus needed for checking the linearity of the combination by the summation method. Photography was a valuable research tool and was perhaps the only way of recording the visual impression produced by a lighting installation. Elaborate methods, such as photographic photometry, were useful but were difficult.

The second part of the paper reviewed some of the more important non-photometric testing procedures and tests under service conditions which affected the study of lighting systems, concluding with a discussion of the requirements of a building suitable for an illumination laboratory and its equipment, pointing out that simple equipment, which could be adapted to different requirements, was often more serviceable than elaborate and expensive gear which was of limited scope.

First-Aid Success

AT the National Competition of the British Electricity Ambulance Centre which was held in London on 6th November two South Eastern Electricity Board teams, Mid-Sussex ladies and the Mid-Sussex (Worthing) men, won the national challenge trophies. These teams now go forward to the Grand Prior's Competition on 20th November when they will meet the winning teams of all other ambulance centres, such as the St. John Ambulance Brigade, Police, Mines, British Railways and so on.

VIEWS on the NEWS

By REFLECTOR

AN additional burden on the British Electricity Authority must be the outcome of the restrictions on domestic coal supplies announced by the Ministry of Fuel and Power last week. It is true that power station stocks are higher than they were at this time last year but this is not likely to ease the electrical situation much when the real trouble is inadequate plant. The Coal Merchants' Federation of Great Britain thinks that the domestic coal situation would not have been so serious if the Government had enforced on the railways and the gas industry the same rigid economy which for the last six years has been required from the domestic coal user.

* * *

Quite a sizable proportion of those named in the *Electrical Who's Who* seemed to be present (or to send regrets for inability to be present) at the reunion dinner of the North Eastern Supply Co.'s Old Employees' Association last week. Including the president, Sir Arnold Gridley, M.P. (whose appearance seems to belie the fact of his appointment as general manager, albeit a young one, of the component Cleveland and Durham Co. nearly 45 years ago) these men gained their early experience in one or other of the companies to whose influence on electricity supply practice everywhere Sir Harold Hartley, the principal guest, paid so warm a tribute. Reminiscent conversations might be summarized without exaggeration by reference to Wordsworth's "Bliss was it in that dawn to be alive, but to be young was very Heaven."

* * *

I am somewhat perturbed at the effects of the new regulations relating to street crossings. That pedestrians should apparently be more inclined to take advantage of the uncontrolled "zebra" crossings and exercise their rights boldly is all to the good but they seem unaware of the fact that, unless the crossings happen to be in a well-illuminated area, they are probably just as invisible to the motorist as they were on the old "Belisha" crossings. The moral appears to be that more care should be taken in siting the crossings in relation to the street lighting or, as has often been advocated before, the crossings themselves should be provided with their own, preferably distinctive, lighting.

* * *

In deciding what firing methods to adopt the pottery industry has, somewhat naturally, paid most regard to costs. But in a paper read before the British Pottery Managers' and Officials' Association last week Mr. Stanley Hind, a consulting ceramic engineer, described this as a short and purely competitive view. He said that it paid much better to cultivate rather than wait for developments. While the development of efficient methods of applying gas in pottery firing had reached a high but temporarily stable standard, that of electricity was still going ahead rapidly. The difference in costs between gas and electricity was also narrowing. Since 1949 the price of gas had risen by about 54 per cent while that of electricity was only 23 per cent higher.

* * *

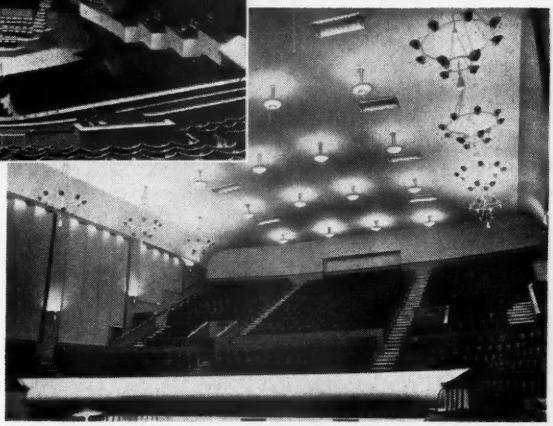
After a visit of members of the Leicester branch of the Electrical Association for Women to the Freemen's Meadow power station, it is recorded by the *Leicester Evening Mail* that the hosts said: "We like to show the generating side of electricity to people who are genuinely interested. It's usually the distribution side that has the glamour." Yes: what can be more glamorous than a cable gang in a muddy trench, for instance.

* * *

I like to encounter fresh points of view in the matter of domestic electrification: here is one emanating from Mr. F. J. York (Northampton Rural Council) and quoted by the *Daily Express*:—

> "Working-class houses should not be stuffed with electrical gadgets and have central heating in all bedrooms. It forces the woman to go out to work to pay the rent."

Colston Hall Bristol



Electrical Arrangements for Lighting, Heating, Ventilation and Acoustics

THE new Colston Hall, Bristol, which was officially opened recently, shares with the Royal Festival Hall, London, the distinction of being one of the two major concert halls erected in this country since the war. It therefore provides a rare opportunity for demonstrating advances made in electrical technique as applied to this type of building, especially in relation to lighting, heating, ventilation, acoustics and fire precaution.

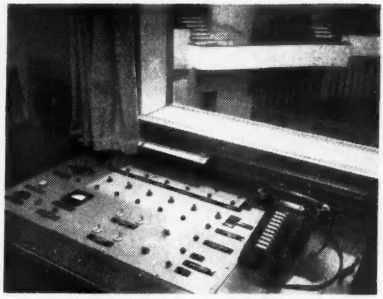
The last-mentioned feature has been the object of special attention since two of the three previous Colston Halls on the same site have been destroyed by fire. The new building just opened replaces the hall burnt down in 1945 and was regarded as a part of Bristol's contribution to the Festival of Britain.

Accommodating 2,000 persons, with room for an additional 182 in the choir seating, the hall is intended to serve not only as a concert hall but also as a boxing arena and a dance hall; the front portion of the auditorium floor is level and a section of the stepped portion of the floor is removable to extend this area if necessary.

The shape of the hall has been largely determined by the acoustical requirements of a concert hall. Large areas of wood panelling are designed to give the required resonance, a large canopy over the platform reflecting the sound to the more distant parts of the auditorium.

Loudspeakers for the public address system (G.E.C.) are housed behind grilles in four banks (each of six 10in moving coil units and four horn type), two situated on each side of the stage. Three additional 10in speakers are concealed in the canopy. Thirty-one microphone points have been provided along the foot and in the centre of the stage, access to the latter being reached through a removable panel in the floor. Twenty-one of the microphone points are required for broadcasting purposes, the British Broadcasting Corporation being provided with a small soundproof

Above left: **A general view of Colston Hall, and** *right:* **The balcony and the ceiling lighting**



The master lighting control panel in the electrician's control and observation room

room at the right-hand side of the stage with a window overlooking the concert platform.

A similar room on the left of the platform is used as the electrician's control and observation room. Besides accommodating the sound reproduction amplifier equipment and gramophone turntables, this houses the master lighting control panel and a separate control switch for the special boxing lights. Similar lighting control boards are provided in a corridor leading from the auditorium and in the main switchroom where the dimming equipment is situated.

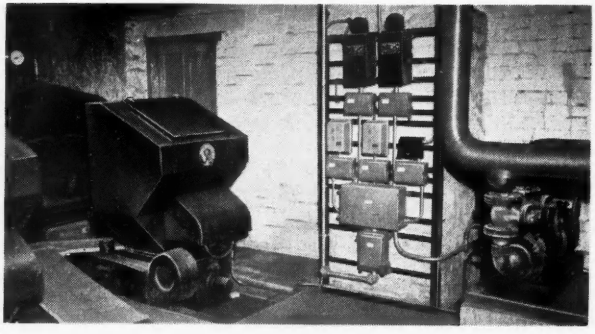
From these boards, which together with the dimmers have been supplied by the Major Equipment Co., Ltd., it is possible to obtain simply, by operating the appropriate switches whatever intensity of lighting is required on any of the seven circuits covered: direct and indirect platform lighting, conductor's spot, underbalcony lighting, side brackets, vent lighting and over-balcony and auditorium lighting.

Altogether about 60 kW is required for lighting purposes and, apart from the generally attractive and harmonious effect produced, probably the most striking feature of the illumination scheme is that tungsten lamps have been employed almost throughout. Fluorescent lighting is to be found only on the side walls, where nineteen 2ft warm-white tubes have been mounted horizontally at a high level and behind the ten grilles of the ventilation air inlets in the ceiling, each housing two 5ft tubes in addition to two 500 W tungsten lamps.

Concealed indirect lighting produces a pleasing effect at the back of the stage. Direct lighting illuminating the performers comes from eighteen 1,000 W lamps recessed in the canopy, two further 1,000 W lamps spotlighting the conductor. No permanent footlights are provided, portable coloured fluorescent fittings being employed when occasion demands.

In addition to the vent lighting units there are suspended from the ceiling twenty semi-indirect decorative bowl type pendants housing four 100 W lamps and also eight 12-light indirect fittings with neat bronze shades concealing thirteen 100 W lamps. To match the latter twelve 4-light brackets are fitted on the walls. Under the balcony concealed cornice lighting is employed supplemented by two louvred pendant fittings. These fittings, together with 75 W wall brackets and exit signs, are connected to a Pritchett & Gold & E.P.S. 101-cell emergency lighting apparatus which is float charged through a selenium rectifier. Decorative pendants and wall brackets are used in the entrance foyer, with spherical pendants in the three buffets and lavatories. All the lighting fittings in the hall were supplied by Troughton & Young (Lighting), Ltd.

"Sadia" water



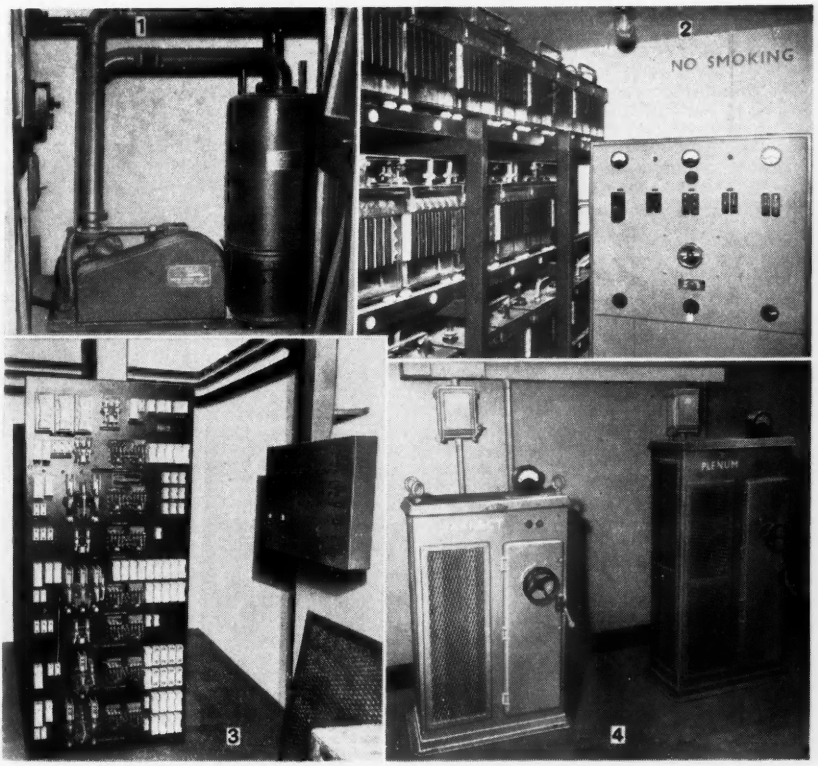
Stoker, boiler house control panel and one of the hot water circulation pumps

heaters of various capacities provide hot water for the lavatories, the boxers' shower baths and the buffets, the latter also being equipped with W. M. Still electric boilers for supplying hot drinks. G.E.C. electric clocks are installed at ten points throughout the building. A Reliance automatic telephone intercommunication system has been installed.

As we have said, special precautions have been taken to guard against fire. Battery operated apparatus at strategic points closes an electrical circuit should the temperature rise sufficiently to cause metallic elements to expand and bring two contacts together. Closing of this circuit immediately rings a bell in the local fire station and at the same time shows on an indicator board in the entrance hall at which of six positions in the building the fire is to be found. Additional warning is given by blue lighting at various points.

Ventilation and heating, for which the Brightside Foundry & Engineering Co., Ltd., was responsible, are carried out by a plenum system. After being filtered, the air is warmed by hot water batteries and then admitted to the hall through ceiling grilles and extracted through ducts under the seats. Provision is made for recirculation of the air if desired, the admission of fresh air being regulated by dampers operated by compressed air. By means of Brookhirst control gear the speed of the Bull 15 h.p. motors driving the plenum and extract fans is regulated according to the outside temperature and the number of people in the hall.

(1) The central vacuum cleaning plant. (2) The emergency lighting plant. (3) Dimmer equipment for the lighting. (4) Speed regulation equipment for extract and plenum fans



The hot water required for the heating is supplied by an anthracite fired boiler with an automatic electric stoker set to operate as required, " Satchwell " controls keeping the water at the desired temperature. Holden & Brook pumps driven by Bull 2 h.p. motors circulate the hot water through the heating batteries of the plenum system. A Kenbar push-button starter controls the stoker, the speed of which is slowed down for the purpose of night operation.

G.E.C. switch-fuse gear is employed both here and in the main switchroom which also houses the Sangamo Weston and Landis & Gyr metering equipment. The ticket office and cloakrooms are warmed by Walsall tubular heaters and G.E.C. 3 kW fan heaters.

A B.V.C. central vacuum cleaning installation driven by a Lancashire Dynamo & Crypto 12 h.p. motor, with Allen West starter, and a Dixon portable combined floor scrubber and polisher keep the building clean.

The electrical installation was carried out by F. H. Wheeler (Bristol), Ltd., the consulting engineers for the electrical and heating work being Hoare, Lea & Partners. We thank Mr. T. J. Pyper, Bristol City entertainments manager, for the facilities given to us to prepare this article.

British Standards

New and Revised Specifications

AMONG recently issued specifications is B.S. 607 (price 2s) on reinforced concrete poles for overhead electric power transmission lines and traction lines which has been revised in order to clarify still further the design requirements and test procedure. The classification of poles has been simplified and a new class has been included which is lighter than those previously covered, making six classes in all. This revision applies also to supports for telegraph and telephone lines but not to either lamp standards or poles reinforced with prestressed steel.

B.S. 1778 (price 2s 6d) relates to 15 A at 250 V three-pin plugs, socket outlets and connectors for theatrical and cinema stage circuits. It has been prepared to facilitate interchangeability of such connectors at permanent socket outlets, on portable switchboards and in " wander " leads.

The revised B.S. 800 (price 3s) specifies the limits of magnitude, duration and frequency of occurrence of radio interference, which may be generated by many kinds of electrical appliances, considered to be adequate for the protection of the majority of broadcast radio receivers. This document does not apply to ignition systems of engines, or to industrial, scientific and medical r.f. equipment (which are covered by B.S. Codes of Practice) nor to interference arising from defective domestic electrical installations. Use of the radio interference free mark has been postponed until this specification has been extended to cover the frequencies used for television.

The Council for Codes of Practice for Buildings has also issued in its final form C.P. 327,201 (price 6s) on broadcast reception (sound and television) by radio, which has been drawn up by a committee convened by the I.E.E. on behalf of the Council. It is part of the series of Codes dealing with telecommunication services inside buildings, while supplementary information will be given in C.P. 327,300 on sound distribution systems, which is to be issued shortly.

Electrical fire alarms are the subject of C.P. 327,404/402,501 (price 5s) which has similarly been drawn up on behalf of the Council by the Institution of Mechanical Engineers and the Institution of Electrical Engineers. It deals with the installation of alarms in buildings, but excludes public alarm systems and those forming part of automatic water sprinkler installations.

Copies of all these documents are obtainable from the Publications Department, British Standards Institution, 24, Victoria Street, London, S.W.1.

Welding Summer School

THE British Welding Research Association announces that in view of the success of the Ashorne Hill Summer School in Welding and Design held in May and June this year, the Association has decided to hold another school next year at the same place from 16th to 25th July.

The school will, on this occasion, be divided into two parts—the first part from 16th July till 20th July, being for those concerned with the purely practical aspects of welding, and the second part from 20th July till 25th July, being for those concerned with design, inspection and manufacturing problems. Further details will be issued later.

E.I.B.A. Ball

Substantial Addition to Funds

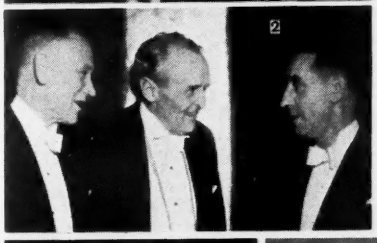
NEARLY a thousand people from all branches of the electrical profession and industry gathered at Grosvenor House, London, W.1, last Friday on the occasion of the annual ball in aid of the funds of the Electrical Industries Benevolent Association. This year there was a reversion to the pre-war custom of providing a dinner before dancing and the increase in attendance may be taken as signifying general approval of the arrangement.

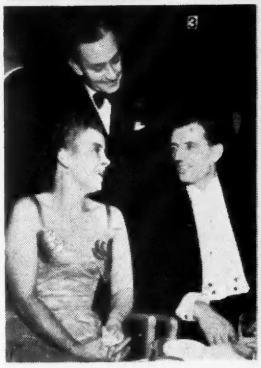
The guests were welcomed on arrival by Mr. C. R. King, president of the Association, and Mrs. King and during the evening the president read a reply from His Majesty the King to a telegram of loyal greeting sent on behalf of the company. Later Mr. King was able to announce that the Association's funds had benefited from the event by about £1,300; included in the total were sums of £392 from the sale of programmes and £136 from the usual "penny" collection.

Through the generosity of a number of companies in the industry forty-four prizes, largely electrical appliances, were presented. The programmes were provided by the British Thomson-Houston Co. and the cost of the other printing involved was borne by Venner Time Switches, Ltd.

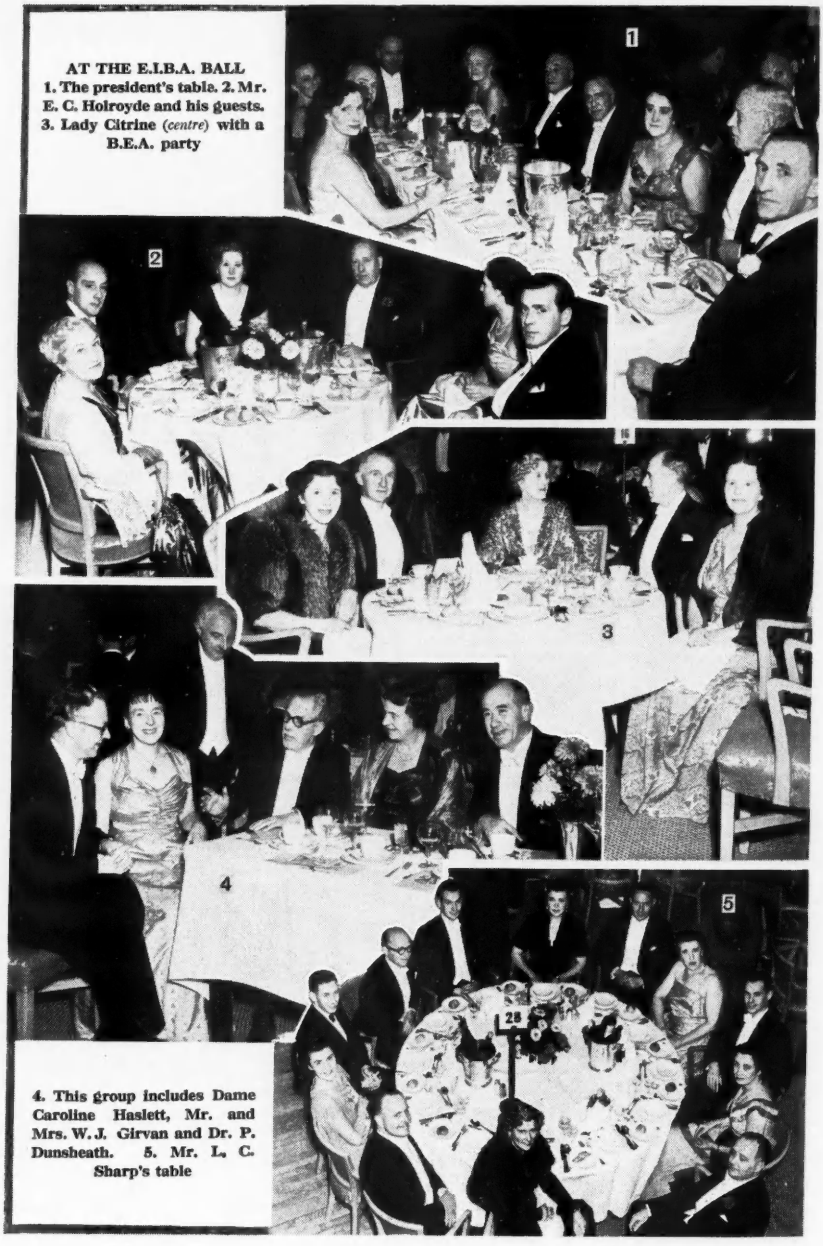
After a buffet supper there was a midnight cabaret.

The secretary of the E.I.B.A., Mr. H. Senior Fothergill, and his assistants are to be congratulated upon a very successful affair.





1. The president and Mrs. King greet Mr. and Mrs. H. S. Pocock (*Electrical Review*). 2. An E.W.F. trio. 3. Mr. and Mrs. V. T. Stock and Mr. V. C. H. Creer. 4. Messrs. W. H. Stacey and H. T. Young. 5. Messrs. E. Peacop and J. Flood



AT THE E.I.B.A. BALL
1. The president's table. 2. Mr. E. C. Holroyde and his guests. 3. Lady Citrine (*centre*) with a B.E.A. party

4. This group includes Dame Caroline Haslett, Mr. and Mrs. W. J. Girvan and Dr. P. Dunsheath. 5. Mr. L. C. Sharp's table

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE President and the Council of the Royal Society have awarded the Hughes Medal to **Professor H. A. Kramers,** for his distinguished work on the quantum theory, particularly its application to the optical and magnetic properties of matter.

Mr. E. S. Waddington, F.S.E., M.Inst.W., A.M.I.E.(S.A.), Associate I.E.E., Assoc. (S.A.)I.E.E., of the Industrial Department, Philips Electrical, Ltd., has again been elected vice-chairman of the B.E.A.M.A. Arc Welding Plant Section. He has also been re-elected vice-chairman of the Finance Committee of the Institute of Welding for 1951-52.

At a meeting of the board of Associated Electrical Industries, Ltd., held on 8th November, the directors accepted with regret the resignation of the Right Hon. Oliver Lyttelton, D.S.O., M.C., M.P., from the chairmanship of the company and from the board of directors, on his appointment as Secretary of State for the Colonies. **Sir George E. Bailey,** C.B.E., M.I.Mech.E., M.I.E.E., M.I.P.E., was unanimously elected chairman of the company in his stead. Sir George became managing director of A.E.I. in 1945, was managing director and deputy chairman in 1946 and 1947, and has been deputy chairman since 1st January, 1948. He is also chairman of Metropolitan-Vickers, Ferguson Pailin and the Hotpoint Electric Appliance Co., and deputy chairman of the British Thomson-Houston Co., Ltd.

Sir George Bailey

Mr. R. W. C. Reeves, M.I.E.E., has joined the board of the Belmos Co., Ltd.

Mr. C. F. Mayer has been appointed to a newly created post of commercial overseas manager for Trico-Folberth, Ltd. He has been export manager of the company since 1946. **Mr. R. M. Van Dyck,** formerly assistant export manager, has been appointed export manager.

The Metropolitan-Vickers Electrical Co., Ltd., has announced the appointment of **Mr. A. J. Budd,** B.Sc. Tech., as assistant superintendent, Motor Department, as from 1st October. Mr. Budd took his degree at Manchester and went to the Trafford Park Works as a college apprentice in 1943, subsequently joining the staff of the Motor Engineering Department as a junior engineer. Later he transferred to the manufacturing side of the department, and in 1949 he was appointed to the position of development engineer.

Mr. A. J. Budd

In view of the expansion of business and the envisaged further extensions at the works of the National Gas and Oil Engine Co., Ltd., it has been found necessary to make changes in the executive in order to cope with the additional load. Consequently **Mr. J. Jones** has now been made managing director, and **Mr. C. F. Barnard** has been appointed general manager, and elected a director. The Hon. A. C. Geddes has resigned from the board of directors.

It is announced by British Insulated Callender's Construction Co., Ltd., that **Mr. F. de B. Hart,** M.I.E.E., has retired from his executive duties with the company but will retain his seat on the board of directors. Mr. Hart has been an electrical engineer for more than forty years, and, during that time, has been closely associated with many important electrification developments both in the United Kingdom and abroad. His initial training was received at Faraday House and, after short periods of service with the Newcastle Electricity Supply

Mr. F. de B. Hart

Co. and Stanley Bros. Colliery, he joined the Callender's Cable & Construction Co. in 1911. Later he went to Spain, where he was in charge of the installation of a complete distribution system in Valencia, and to Hungary, where he was in charge of the construction of a 110 kV overhead line, one of the first lines in Europe at such a high voltage. In 1929 he was appointed contract manager in the company's Overhead Department and in 1942 he was made chief construction engineer in the Civil Engineering Department.

When the B.I.C.C. group was formed in 1945, he was appointed manager of the group's Civil Engineering Department. Later, when the group's subsidiary, British Insulated Callender's Construction Co., Ltd., was formed in 1949, Mr. Hart was appointed an executive director and joint manager of the Developments and Special Projects Department. To mark his retirement he was entertained at dinner at the Old Bell Restaurant, Holborn.

After six months' illness **Mr. Allen Hirst,** acting under medical advice, is retiring from the board of Brookhirst Switchgear, Ltd.

Mr. Allen Hirst

Mr. Hirst, after an early training in cotton, law and electrical engineering and following service in France with the R.F.A. and the R.A.F. in the 1914-18 War, joined Brookhirst in 1919. He became joint managing director in 1941. Mr. Hirst is a nephew of the late John A. Hirst, who founded Brookhirst and was a past-chairman of B.E.A.M.A. He is also a director of Sezincote Stud, Ltd., in Gloucestershire, which was founded by his late uncle, and whose six yearlings last September at Doncaster were sold for 20,800 guineas. We are glad to hear from Mr. Hirst that he is now recovering from his illness. Mr. Hirst is leaving, with Mrs. Hirst, in January for a sea trip calling at Curaçao, Los Angeles, San Francisco, Victoria and Vancouver.

Mr. B. E. Stott has resigned his position as managing director of Ferrous Castings, Ltd., owing to ill-health. **Mr. D. Robertson,** general manager of the company, has been appointed a director.

Mr. H. W. Bosworth, A.M.I.E.E., chairman of Lancashire Dynamo Holdings, Ltd., and of Lancashire Dynamo & Crypto (Mfg.), Ltd., is to make an extensive tour of Australia and New Zealand, leaving this country on the liner *Oronsay* on 21st November and returning via Panama in March of next year.

Enfield Cables, Ltd., announces that **Mr. Stephen Chaplin,** M.I.E.E., has been made an associate director. Mr. Chaplin joined the company in 1929 as assistant to Dr. E. Bowden, then technical director. He became assistant contracts manager in 1936 and then C. M. A. liaison officer for emergency repairs in Mid-East England from 1939 to 1945. He was resident engineer on the Osbaldwick 132 kV compression cable installation at York in 1945.

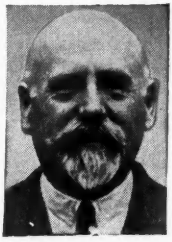
Mr. S. Chaplin

Among the passengers on a B.O.A.C. stratocruiser to Montreal was **Mr. R. W. Towers,** sales director of the Rheostatic, Ltd. Mr. Towers will be travelling from Montreal to Toronto and later to New York, returning to the United Kingdom on 26th November.

Mr. F. Spencer, who has been acting manager at the Croydon branch of Brown Brothers, Ltd., since April last, has now been appointed manager of that branch.

OBITUARY

Mr. W. Riggs.—We regret to record the death of Mr. Walter Riggs, M.B.E., M.I.E.E., which occurred on 10th November at the age of seventy-four. Mr. Riggs was educated at Finsbury Technical College under Professor Silvanus Thompson and received his practical training with the Westminster Engineering Co. Subsequently he joined the P. & O. Company and was one of the founders of the Batti-Wallahs' Society of which he was elected an honorary member in 1948. His activities in the electrical contracting industry are well known and he had been a member of the Electrical Contractors' Association and allied associations for many years, serving as president in 1924-25 and during the years 1938-45. Among his interests outside the electrical industry he was a member of the Council of the Royal National Lifeboat Institution and honorary secretary of the Aldeburgh Branch Station of the R.N.L.I., having himself taken part in much lifeboat work. He was a director of the East Suffolk Electricity Distribution Co., Ltd., and the Burford Electric Light Co., Ltd., before

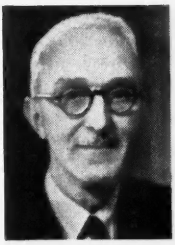


The late Mr. Walter Riggs

nationalization. Mr. Riggs was chairman of Birdlestone & Co., Ltd., and associated companies at the time of his death.

Mr. R. Halsall.—The death occurred suddenly on 9th November, at the age of fifty-five, of Mr. Reginald Halsall, F.S.A.A., deputy secretary of the British Electricity Authority. Mr. Halsall was taken ill outside the Authority's offices in Great Portland Street, and on being taken to Middlesex Hospital was found to be dead. After training with a firm of chartered accountants, Mr. Halsall joined the Ministry of Munitions in 1918, and was subsequently with the Inland Revenue Department (1921), and assistant secretary, Ministry of Aircraft Production (1941), assistant secretary, Board of Trade (1944), and deputy secretary, Central Electricity Board (1945-48), before becoming deputy secretary of the B.E.A.

Mr. E. L. Hayward.—The death occurred on 31st October, after a long illness, of Mr. E. L. Hayward, at the age of fifty-nine. Mr. Hayward entered the service of Siemens Brothers Dynamo Works, Ltd., in 1913, and was transferred to the newly formed Lamp Co. in January, 1921. He was appointed joint secretary of Siemens Electric Lamps & Supplies in 1946 and secretary of Battery Carbons, Ltd., in March, 1950. He served in the Army from 1914 to 1918, and was awarded the Military Medal.



The late Mr. E. L. Hayward

The Scarcroft Case

Yorkshire Board Appears at Assizes

At the Leeds Assizes on Monday the Yorkshire Electricity Board before the Lord Chief Justice (Lord Justice Goddard) pleaded guilty to five charges in which it was accused of exceeding by £41,217 an authorization to extend its headquarters at Scarcroft, near Leeds.

The chairman of the Board, Col. W. M. Lapper, and the deputy-chairman, Mr. F. Newey, pleaded not guilty to five similar charges.

Opening the case for the prosecution, Mr. G. R. Hinchcliffe, K.C., said that the object of the prosecution was to make it clear that a nationalized industry was not above the law. The allegation was simply that a vast amount of unlawful work was done in excess of an authorization for £32,000 by the Ministry of Fuel and Power and that part of the work done was in contravention of proposals that had been put forward by the Board and approved by the Ministry.

Mr. Hinchcliffe submitted that Col. Lapper and Mr. Newey knew that the contraventions were taking place and did nothing to ensure that applications for authorization were properly put to the Ministry. He thought that the evidence would satisfy the Court that Messrs. Lapper and Newey were taking an active control of administrative matters which might have been better left to the heads of the departments. Counsel went on to detail the proceedings which were taken in connection with the Scarcroft extension by the Board and the Ministry. He said that the Ministry had refused to approve dining room and kitchen arrangements proposed by the Board. Fresh drawings were prepared, approved by Col. Lapper and Mr. Newey, and sent to the Board for authorization.

On 12th September, 1949, Mr. Newey told the Board that they had had authorization from the Ministry for the scheme at an estimated cost of £32,000. By that time work had already started and a tender for heating had been accepted, a tender which was later doubled to heat the new extension.

Mr. Hinchcliffe said that the work had proceeded with "indecent haste" to have it finished in time for the visit of the chairman of the B.E.A. Work was done at night by floodlighting and £8,000 was spent on overtime. Walls were removed and offices deleted so that the dining room was much larger than in the approved plans. The main items of excess expenditure were:—Heating system £17,321; dining room £2,335; electrical installation £5,368; and overtime £8,000. The rest was made up of additional printing, plumbing and rooms in the basement. Four clocks were installed in a tower at a cost of £464.

In May, 1950, the contractor withdrew his men and in June he wrote to the Board drawing attention to the building licensing regulations. The extension was opened by Lord Citrine in June and from then until January, 1951, the work continued by direct labour.

The Ministry began inquiries in December, 1950, and on 29th December Col. Lapper

said at a Board meeting that work had been carried out substantially in accordance with the plans approved by the Ministry. In January, 1951, Mr. Newey told Mr. Appleyard, the architect, to draw a screen on the plan of the extended dining room and describe one end as "typing pool—future."

Mr. J. M. Dodds, the secretary of the Yorkshire Electricity Board, was the first witness for the prosecution. Replying to Lord Justice Goddard, he said that the money for the work had to be found by the consumers. He had never been asked for reports on how the money was being spent and it was not until the matter was raised in the House of Commons that anyone took any notice.

His Lordship suggested that as legal adviser to the Board Mr. Dodds should have known that work should have been kept within the authorized figure. Was any warning given? Mr. Dodds replied that this was only one of many licences going through; he understood that these applications numbered 300 a year. He could not recall anyone asking whether the work was being kept within the amount allowed. He had assumed that other people on the Board had secured authorization.

Mr. Dodds said that following a letter from the Ministry in which it was stated that a breach of the Defence Regulations had been committed by the Board, the chairman said at a Board meeting that the building expenditure was £70,000. The deputy chairman corrected him and said that the total expenditure was £100,000.

Asked by His Lordship if anybody had said that the Board had enormously overspent, Mr. Dodds said that Alderman Barber, a part-time member, said so and others in general agreed with him. He could not recall what was said but the chairman and deputy-chairman were certainly concerned about it. The chairman said that the plans were generally in accord with those approved by the Ministry. He did not regard the obtaining of licences as coming within his sphere.

Responsibility for Licence Applications

Cross-examined by Mr. Geoffrey Veale, K.C., appearing for Col. Lapper, the witness said that the actual obtaining of licences was never regarded as being within the purview of the chairman or deputy-chairman. He would expect the engineering department to make the application.

Mr. D. Gerrard, K.C., representing Mr. Newey, produced a note sent from Mr. Packer, of Mr. Dodds' department, to Mr. Dodds about a telephone conversation with a Ministry official. The note said that the answer agreed upon should read:—"The work has now been completed and the Y.E.B. have expended the amount authorized."

Lord Goddard asked Mr. Dodds if he would have agreed with that answer when he knew that they had spent double the amount authorized. Mr. Dodds said it was a repl suggested by London with which he personall disagreed.

Mr. E. G. McKenzie, principal of the Elec tricity Department, Ministry of Fuel and Power, described two visits he had made to Scarcroft while the plans for the extensions were being prepared. He also gave details of letters sent to Mr. Siviour, then the Board's chief engineer, and to Mr. Newey stating the Ministry's attitude towards the extensions and expressing the view that it was only necessary for the dining room to accommodate half of the staff at one sitting. He later received plans for a scheme with a smaller dining room and kitchen at a cost of £32,000 and these were approved.

Preparation of Plans

When Mr. S. R. Siviour, chief engineer from 1948 to June, 1950, took the oath, Lord Justice Goddard told him he was not obliged to answer any question which he thought might incriminate him. Mr. Siviour said that in the autumn of 1948 he was asked by the chairman if his staff could make plans for the proposed extension. If he had known the extent of the work he would have asked for the employment of an outside architect.

Copies of several letters dealing with the plans were produced, including the original application for £13,500. Mr. Siviour said that he had nothing whatever to do with that; it was signed in his name by the architect. Only the letter asking for authorization of the revised plans costing £32,000 had been signed by himself.

Cross-examined by Mr. G. Veale (for Col. Lapper) the witness said that Mr. Appleyard, the architect, received instructions direct from the chairman. He agreed that this was because Col. Lapper did not wish to add to his (Mr. Siviour's) load. When he had asked Mr. Appleyard whether some special steel girders required would make any difference to the cost, Mr. Appleyard said he did not think so.

The Lord Chief Justice suggested that Mr. Siviour must have known that the authorization was being exceeded. Mr. Siviour said he had asked the architect if his building costs still stood and was told "Yes."

Answering Mr. Gerrard (for Mr. Newey), the witness said that normally the chairman and deputy chairman did not have anything to do with applications for 56A authorization but in this case they had both taken part in the negotiations. He agreed that Mr. Newey had been anxious that there should be proper supervision. He also agreed that although he knew that a great deal of overtime was being worked he did not raise the question with Mr. Newey or Mr. Appleyard.

When Mr. Siviour said that a report which he had prepared for the Board as a basis for application was not accompanied by detailed

specifications, Lord Goddard suggested that this was extremely unwise and Mr. Siviour agreed.

Mr. L. T. Appleyard, assistant construction engineer to the Board and the architect who designed the extensions, said that the figure of £32,000 was for the building alone. The heating was to be carried out by the commercial department, the garden work was in charge of the estates department, the furniture and furnishings were in charge of the purchasing officer, the canteen layout and fittings were in charge of the commercial department and the painting at the commencement of the work was in charge of the estates department.

The witness gave particulars of alterations to the plans as approved by the Ministry. The instructions were given by the chairman; witness did not remember whether Mr. Newey was present.

The case was still proceeding when we went to press.

Report on Lamp Industry

Monopolies Commission's Recommendations

AFTER protracted investigations the Monopolies and Restrictive Practices Commission issued its report on the electric lamp industry last Tuesday (H.M. Stationery Office, 6s). The report covers electric filament lamps "for illumination or otherwise" and electric discharge lamps.

The Commission estimates that members of the Electric Lamp Manufacturers' Association of Great Britain (E.L.M.A.) are responsible for about 60 per cent of the output of these lamps and it considers that the collective enforcement of resale price maintenance by E.L.M.A. by means of fines and a stop list should be brought to an end and should not be replaced by any other method of collective enforcement.

It is also thought that the rules should be altered to extend the permission given by E.L.M.A. to co-operative societies to pay dividends on E.L.M.A. lamps to cover any general price reduction made by a distributor by means of a dividend or other method which does not single out products of particular manufacturers. The Commission says that the fines and stop list have been used in moderation for the specific purpose of enforcing resale prices.

On balance, the Commission sees no sufficient reason why the E.L.M.A. system should be completely broken up, but it thinks that safeguards for the public interest should be provided. Given these safeguards it does not recommend that members of E.L.M.A. should be prohibited from continuing to fix minimum selling prices for agreed types of lamp sold by them to wholesalers, to retailers or to users, provided that steps are taken to ensure that the system of exchange of technical knowledge extends to all manufacturers who are within the system of common prices, and that the level of the prices fixed should be reasonable. The Government should review the prices from time to time.

The recommendations "for changes in the system and for safeguards on the manufacturing and on the distributive side to maintain and strengthen effective competition" include:—(1) That E.L.M.A. should undertake that members who sell lamp components (other than patented components and ready-coiled filaments) will make them equally available to members and non-members at prices which shall not be higher to non-members than to members. (2) That if the working of the Association's new policy regarding patents results in an appreciable reduction of the degree of competition to which E.L.M.A. is subject, the whole question should be examined afresh. (3) That E.L.M.A. members should give an assurance that firms controlled by E.L.M.A. members will continue to provide a measure of competition as suppliers of cheap lamps, and that they will not be used as "fighting companies." "Fighting companies" are described as those which "as a matter of policy sell lamps regardless of cost specifically in the markets of independent manufacturers." (4) That the sales quota system should be ended. (5) The rules about the lower-priced "Type B" lamps should be altered to remove quantity and quality restrictions.

Under the E.L.M.A. system there was no price competition between E.L.M.A. lamps at any stage. All wholesalers of E.L.M.A. lamps had to undertake not to sell non-E.L.M.A. lamps and retailers received an extra discount (5 per cent) if they agreed not to sell non-E.L.M.A. lamps. These exclusive agreements were enforced by E.L.M.A. by fines and the power to cancel agreements.

E.L.M.A.'s argument for requiring its wholesalers to be exclusive was that they must be given confidential lists of customers (with details of the special discounts allowed in some instances) and that it could never take the risk of entrusting this information to a wholesaler who also dealt with its competitors. The Association pointed out that there were many other wholesalers who, since they did not trade in E.L.M.A. lamps, were available to the independent manufacturers. The Commission

considers that it is against the public interest that exclusiveness should be required and recommends that the practice should be ended. Out of an estimated total of about 35,000 retailers of general service filament lamps 19,000 had signed exclusive agreements with E.L.M.A. entitling them to the 5 per cent extra discount.

Independent manufacturers competed by offering higher margins to retailers rather than a lower price to the general public, so that the effect of E.L.M.A.'s preferential discount had been to transfer competition from the stage of the consumer to the stage of the distributor.

It is concluded that it is contrary to the public interest for E.L.M.A. members to give retailers a pecuniary inducement to buy their lamps exclusively, and that this practice should be brought to an end.

The British Electricity Authority when reviewing its own system of retail lamp distribution decided not to sign any exclusive agreement with E.L.M.A., though many of the former supply undertakings which it had absorbed had previously done so; nevertheless the B.E.A. enjoyed the same discount as retailers who sign exclusive agreements.

The Commission also recommends the ending of certain other rebates and discounts to wholesalers. The report quotes a table submitted by E.L.M.A. showing that while British prices for lamps were among the highest in the world in 1939, by this year they were the lowest outside the United States.

"Regulated Competition"

The Association said that it was the basis of its submission that the common price, the quota system and E.L.M.A.'s trading methods generally together formed the basis of "a system of regulated competition" the first result of which was to create stability in the industry. Its methods had resulted in a steady, consistent and progressive fall in real costs of production and price and more efficient lamps. Reasonable but not excessive margins were provided to the distributors, thus ensuring efficient distribution while meeting "the wish of the private consumer for a standard price for a standard branded article." The system as a whole operated in the public interest. A "price war" would in the long run be very harmful to the stability of the industry.

On the fixing of uniform resale prices E.L.M.A. believed that the smaller distributor should be protected against unbridled competition from the larger distributor who, by virtue of volume could possibly sell at a lower figure. It was submitted that present discounts were reasonable and that exclusive dealing agreements were entered into voluntarily by a buyer in a competitive market.

Sanctions to enforce price maintenance and exclusive dealing were reasonable; the stop list had been used very sparingly indeed.

The use of a separate firm to make the lower grade article (however good it be in its class) was a normal business practice and in the public interest.

The Commission groups the principal lamp manufacturers in three classes:—

(1) E.L.M.A.:—B.T.H., Ediswan and Metrovick (subsidiaries of Associated Electrical Industries), Osram; Philips and Stella (subsidiaries of N.V. Philips Gloeilampenfabrieken of Holland); Cryselco (jointly owned by G.E.C. & Philips (Holland)); Siemens; Crompton; British Electric Lamps; and Aurora Lamps.

(2) Manufacturers of lamps who are not themselves members of E.L.M.A. but are controlled by members of E.L.M.A.:—Britannia Electric Lamp Works; Evenlite Tube Lamp Developments; Gnome Electric Lamp Works; Ismay Lamps; and Splendour Lamp Co. Their output is rather less than a quarter by quantity of the total output of filament lamps by E.L.M.A. members.

(3) The independent manufacturers:—Manufacturers of lamps who are not members of E.L.M.A. and are neither financially linked to nor controlled by members.

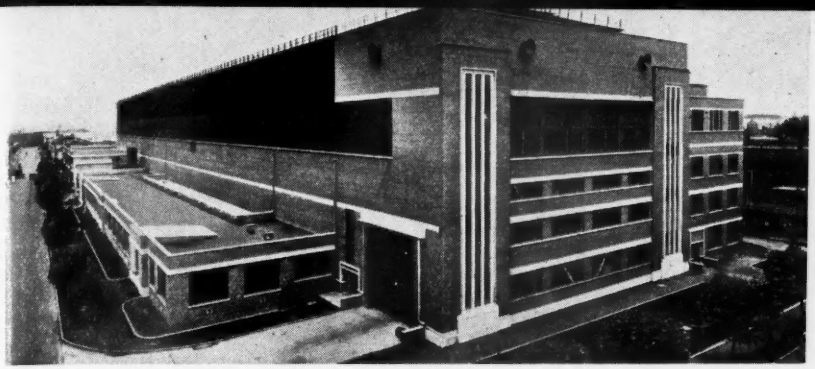
Production Figures

In a general survey of the industry the report states that the total output of all types of filament and discharge lamps last year in the United Kingdom was 252,382,000 with E.L.M.A. and the controlled companies responsible for 73 per cent of the output of filament lamps and independent manufacturers 27 per cent. The output of discharge lamps was 62 per cent and 38 per cent respectively. The total value of filament and discharge lamps at manufacturers' selling prices was about £13,250,000.

Last year 36 million lamps valued at rather more than £1,500,000 were exported and some 40,500,000 valued at £250,000 imported. The greater part of the imports consisted of flashlamps whereas two-thirds of the value of the exports were filament lamps, other than flashlamps, and a quarter were discharge lamps. Figures submitted by the manufacturers showed that 17,500 people were employed in the production and distribution of lamps in 1949.

Some independent manufacturers had represented that the great majority of the 100 odd patents held by E.L.M.A. had little or no intrinsic worth but that in the aggregate they tended to "intimidate" the smaller independent manufacturers who "hesitate to enter a field surrounded by a confusing multitude of patents" and might even be unable to afford to discover their legal strength in relation to them.

On receiving these representations, the Commission examined the fluorescent patent fields of G.E.C. and B.T.H., the main patentees domiciled in this country, to see whether there was evidence of intention to hold patents simply to hinder competitors, or to take out or maintain patents known to be worthless. The examination revealed no such evidence.



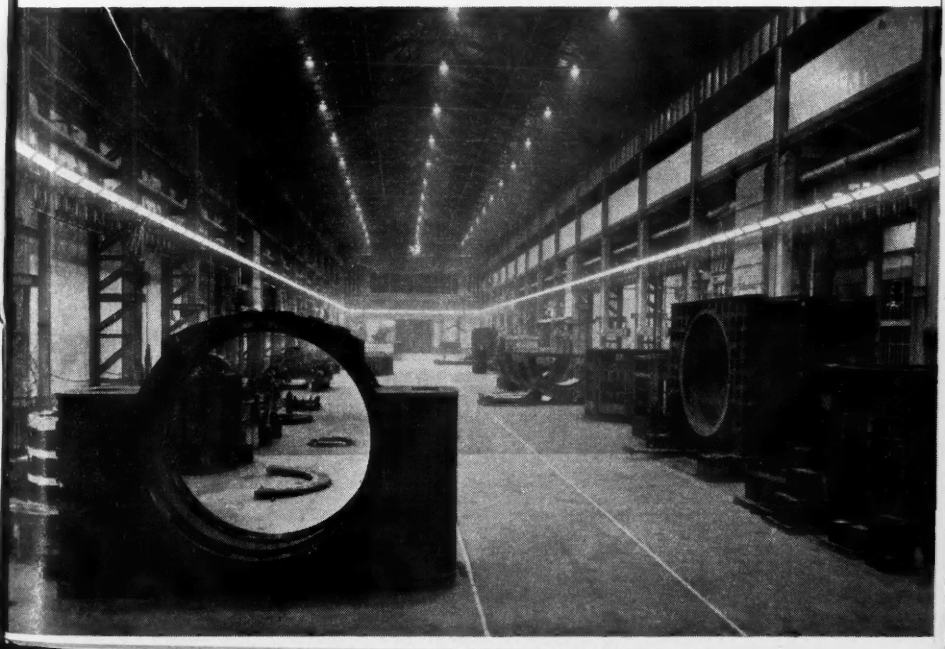
New G.E.C. Works

Heavy Engineering Equipment Production at Witton

THE doubling of the General Electric Company's production of large turbo-alternators (10 MW and upwards), water-wheel alternators and motors for rolling mills, winders and ship propulsion will result from the completion of an entirely new factory at Witton. The easing of the load on the other engineering shops, coupled with large extensions now in progress of the transformer and switchgear departments, will also lead to an increased output of other types of heavy engineering equipment.

The new building covers about $2\frac{1}{2}$ acres, the main erection and test bay being 525ft long by 100ft wide. Two 110 ton overhead travelling cranes operating over the full length provide for a maximum lift of 200 tons. Four core-building pits 6ft deep are equipped with hydraulic jacks for com-

Above: **The new heavy engineering works at Witton, Birmingham.** *Below:* **Main erection and test bay by night showing the even illumination obtained**



pressing the core stampings, three designed for a total loading of 200 tons, and the fourth for 50 tons. Facilities are provided for ring flux testing of the cores both during assembly and when completed. An electronic dynamic balancing machine, designed in the company's development laboratory, balances rotors up to 50 tons in weight to an accuracy of a tenth of an ounce at the periphery.

The various test beds, which include a raised bed for turbo-alternators, an overspeed rotor test pit and a test bed for waterwheel alternators, occupy a floor space of abour 160ft by 100ft. Along the full length of the building and served by a 10 ton overhead crane is a bay 40ft wide, about half of which is devoted to forming the rotor windings and to certain finishing processes on the stator coils. The remainder of the bay is devoted to stores and office accommodation. The two main doors to the building are of the motor operated concertina type.

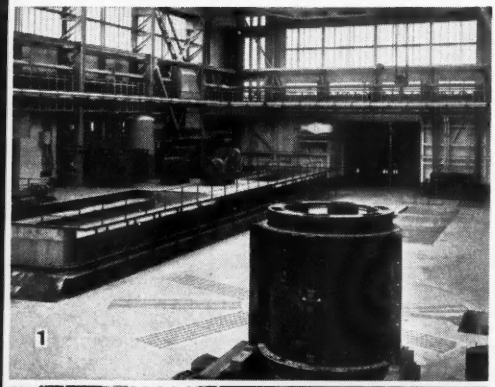
A passenger lift and a 2 ton goods lift are situated between the stores and winding section above which is a further floor extending the full length of the building. Except for a drawing office the whole of this floor is used for making stator coils and formers. A 2 ton travelling crane runs the length of the stator coil section, transport of the coils to the ground floor being provided by a 5 ton dual-capacity Express lift. This lift handles loads of 2 tons at 150 ft/min or 5 tons at 50 ft/min.

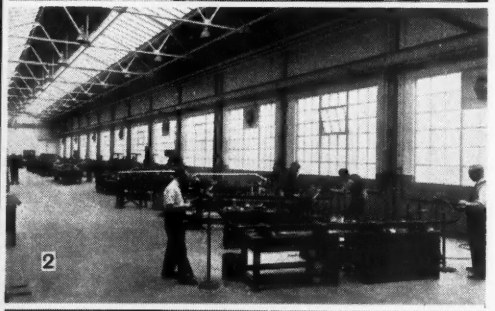
The indoor substation, which houses the power plant and all associated switchgear required for test purposes and power distribution in the works, adjoins the test beds, and covers about 6,800 sq ft. Close to it is an outdoor substation where seven transformers and two saturable reactors are installed, together with two air-blast water spray coolers for the closed ventilating circuits and the liquid starters of the alternators on test.

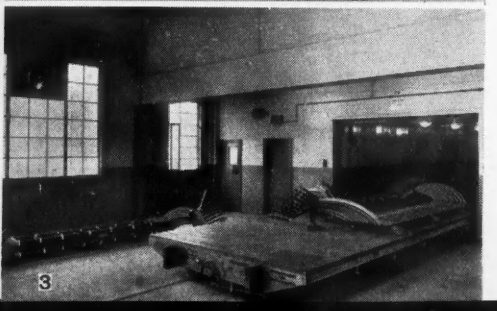
In addition to accommodation for administrative staff, the new building will house the education and training department, technical library and lecture theatre with a projection room.

In the heating and ventilating system full use is made of heaters of the unit blower type, the flow of steam to these being regulated by motor-operated valves, either actuated automatically by thermostats or remote controlled. Both the two speed fan motors and the motor-operated dampers controlling the intake of fresh and recirculated air are remotely controlled from a master switchboard equipped with indicators showing the positions of all dampers. Further regulation of the rate of air change is provided by extractor fans arranged for group control from the master control board. In the offices provision is made for two air-changes per hour throughout the year, the air being extracted by "Xpelair" fans.

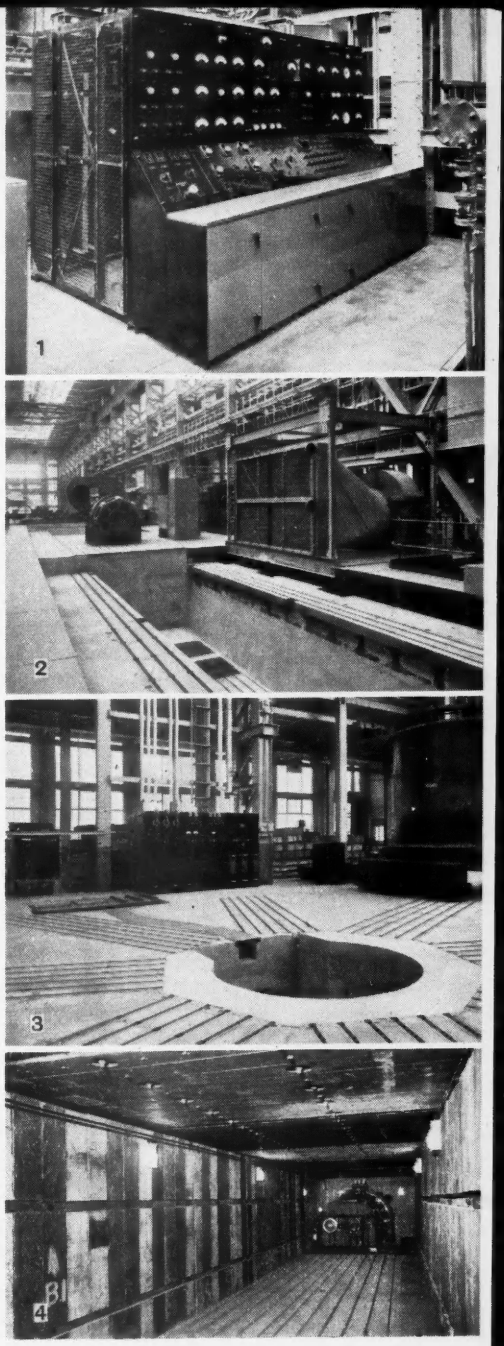
Lighting of the main erection and test







(1) General view of the test beds. In the foreground is a stator for a 60 MW turbo-alternator. (2) Stator coil production on the top floor. (3) Completed stator coils, loaded on the truck, entering the 5 ton dual-capacity lift



(1) Main control board on the test bed for turbine-driven alternators. (2) Turbine-driven alternator test bed, showing the driving motor and the removable platform on which fans and cooler for air-cooled alternators are mounted. (3) Test bed for water-wheel alternators with control board in the background. (4) Inside of the overspeed pit showing the thick timber facing, and the driving motor

bay is by forty-eight 1,000 W h.p. mercury vapour discharge lamps supplemented by continuous lines of low brightness fluorescent lamps along the sides and ends of the building. The average service illumination is 25 lumens/sq ft. For the side lighting, 194 " Perspex " trough reflectors, each housing two 5ft 80 W fluorescent lamps and installed in continuous lines, maintain a high intensity of illumination over the fitters' benches and on the vertical surfaces of machines under construction. In the winding bays, ground floor stores and substation, 400 W h.p.m.v. fluorescent discharge lamps with vitreous enamelled dispersive reflectors are used and office lighting is provided by 5ft 80 W fluorescent lamps with " Perspex " reflectors.

The main test bed for the turbine-driven alternators comprises an 8ft high central platform on each side of which is an alternator bed 50ft 6in long and 6ft 3in above the shop floor. With this arrangement, one machine can be erected or dismantled while a second is on test. Each of the alternator beds forms a pit below the machine and is provided with air ducts for the closed circuit ventilation of air-cooled alternators. A hydrogen detraining tank forms part of the test equipment so that hydrogen-cooled alternators can be run under operating conditions.

All alternators can be tested at full voltage and current, two saturable reactors being provided whereby loads up to 100 MW at very low power factor can be imposed on the machines. In the event of a breakdown of the oil pumps a header tank, designed for a working pressure of 50 lb/sq in and having a capacity of over 2,000 gallons, ensures an adequate supply of oil to the bearings during the time taken to shut down the plant.

For complete tests constant speed with no risk of overspeed is essential. For this reason the induction type driving motor is connected through two induction regulators and a 2,000 kVA step-down transformer to the 11 kV supply. The regulators give a variable voltage from 0 to 760 V. The

motor is rated at 2,000 h.p. 2,950 r.p.m. and has a double shaft extension. If greater driving power is required, a second motor can be coupled in tandem. The control board is situated on the steel platform alongside the middle section of the test bed.

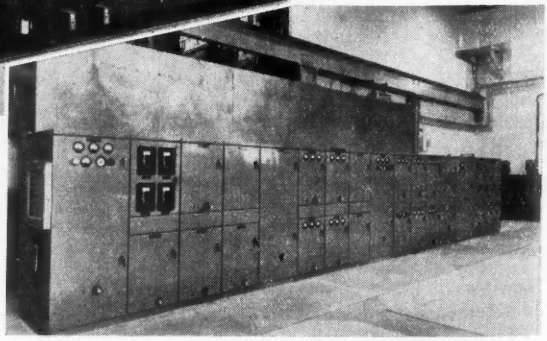
The overspeed pit, designed to accommodate rotors for turbine driven alternators, is over 60ft long by 11ft wide and is of heavily reinforced concrete construction, about 300 tons of steel being used. Over a length of 37ft 6in the sides of the pit are protected by steel boxes filled with sand. A final facing of timber, 10in thick, completes the protective arrangements. The pit is completely covered by seven 30 ton steel slabs.

For the overspeed testing, a 2,000 h.p. d.c. motor with Ward-Leonard control drives the rotor through speed increasing gears, and is designed for a voltage range of 0/600/750 V and for speeds up to 900 r.p.m. Rapid starting and stopping can be achieved, and full use made of the regeneration of power when closing down the test. The motor and gearing are mounted on a bedplate to form a self-contained transportable unit, which can be used to drive a variable frequency alternator for the overspeed testing of water-wheel alternators.

In the water-wheel alternator test bed tests undertaken include the determination of open and short circuit characteristic curves and the measurement of losses, as well as overspeed testing. A 2,000 h.p. d.c. driving motor mounted on top of the alternator in place of the exciter is Ward-Leonard controlled to provide a speed range from 0 to 800 r.p.m. Where higher speeds are required, the alternator complete with its exciter is run as a synchronous machine, and is supplied with variable frequency from an alternator rated at 5,000 kVA, 5,000 V with a frequency range up to 150 c/s.

In the substation three incoming supplies are available from two 11 kV feeders; a 460 V 3-wire d.c. supply for the cranes and general works services; and an emergency 400 V 3-phase, 4-wire, supply.

The main power unit comprises a 750 h.p. 440 V synchronous induction motor direct coupled to a 4,000 kVA alternator, a 2,000 kW d.c. generator and two exciters. It is connected to the 11 kV supply through a 750 kVA step-down transformer. The alternator is specially wound to generate at voltages of 11 kV, 6·6 kV, 5·5 kV or 3·3 kV according to the stator connections used. The plant can be run as a motor generator for the



Above: **Heavy current a.c. and d.c. switchboard in the substation**
Right: **The 440 V a.c. distribution board in the substation**

Ward-Leonard control of the 2,000 h.p. motor in the overspeed test pit or of the driving motor for water-wheel alternators. Alternatively, the 4,000 kVA machine may be driven as an alternator for supplying current for ring flux tests of stator cores, and for stator reactance measurements. If necessary, additional driving power can be obtained by running the d.c. generator as a motor. For supplying the excitation current for machines on test, a 360 kW, 400 V motor generator is installed. Provision is made for installing a further motor generator comprising a 4,000 kVA synchronous machine direct coupled to a 2,000 kW generator.

Outdoor Transformers

A variable voltage a.c. supply for the 2,000 h.p. driving motor on the alternator test bed is obtained from a 2,000 kVA 11,000/380 V outdoor transformer in conjunction with two motor-operated induction regulators. Each is rated at 500 kVA and provides a voltage range from 0 to 760 V. The two outdoor saturable reactors for providing the load on the alternators on test are rated at 75 MVA at 22 kV and 11 kV, or 37 MVA at 6·6 kV. They can also operate at 100 MVA at 15 kV on a 3-hour rating. D.c. for saturating the reactors is obtained from a 325 kW grid controlled pumpless steel tank rectifier situated in the indoor substation.

The largest of the seven transformers in the outdoor substation is rated at 4,000 kVA for the heavy current a.c. supplies to the test bay. It receives power from the 4,000 kVA alternator of the main motor generator set in the indoor substation. The secondary windings give alternative voltages of 880 or 550 V. Three transformers, two rated at 1,000 kVA and one at 500 kVA, are installed for the 440 V a.c. distribution system, and a 750 kVA unit supplies power to the 750 h.p. driving motor of the main motor generator set. The remaining two units supply the induction regulators and grid-controlled rectifier and are rated at 2,000 kVA and 600 kVA respectively.

An eight-panel metalclad switchboard, with breakers of 250 MVA breaking capacity, controls the two incoming 11 kV feeders and the six outgoing feeders to the power transformers. The switchgear is remotely operated from a control and metering board in the substation. For the 440 V a.c. distribution system, and for all essential test auxiliaries, an eighteen-panel air-break switchboard is installed. Flat-back switchboards are provided for the heavy current a.c. and d.c. supplies to the test beds and core pits, and for the 460 V d.c. distribution system.

The heavy current busbars used in the main erection and test bay are of aluminium strip or channel. For the 5,000 A bars, 8in by 3in channel was chosen because it provides more efficient cooling and reduces skin effect when the bars carry a.c. The three busbars are arranged in triangular form, slots in the supporting plates and in the busbars allowing for any movement caused by expansion. The expansion joints consist of aluminium strip formed in packs of eight, with three packs for each busbar. For essential house services the totally enclosed "plug in" busbar system is used.

In the transformer works a further 175ft has been added to the main erection bay which is 60ft wide. A new drying stove will accommodate transformers up to the largest sizes. Additional oil treatment plant and oil storage tanks are installed, together with pumping equipment for feeding the oil to various distribution points throughout the main bay. A further 175ft by 28ft extension houses the core preparation section formerly situated in the main bay and a new two-storey bay, 275ft long by 60ft wide, serves as a despatch department for both the transformer works and adjoining high voltage switchgear works and for the h.v. switchgear stores: the upper floor of this bay is devoted to the light winding and small assembly sections.

Switchgear Works Extensions

The extensions to the h.v. switchgear works were made necessary by the rapidly growing demand for circuit breakers with capacities above 2,500 MVA and for voltages up to 275 kV. The main assembly bay, which is 60ft wide, has been extended by 300ft and the fabrication section has also been lengthened by 175ft. The additional floor space has permitted a complete reorganization of the fabrication shop and new presses of the latest type have been installed.

The press shop, sheet metal stores, tool room with its drawing office, as well as the tinsmiths' shop, are being centralized to form a self-contained feeder works. Im-

proved manufacturing methods have been introduced and the layout is planned for flow production. As a direct result of this reorganization a considerable increase in output has been achieved.

Among turbo-alternators already under construction or shortly to be manufactured in the new extensions are units for Uskmouth power station (six 60 MW hydrogen-cooled), Ince (three 60 MW h.c.), Hams Hall " C " (three 60 MW h.c.), Johannesburg (five 30 MW), Huncoat (four 30 MW), Woolwich (two 30 MW), Doncaster (two 30 MW), Huddersfield (two 30 MW) and Haifa (one 30 MW).

Contracts for water-wheel alternators include four 25 MW units for Tasmania, three 25 MW units for Errochty, and one 5 MW unit for Pangani, Tanganyika. Many winders are on order for the National Coal Board, and rolling mill motors of up to 5,000 h.p. are being made both for this country and Australia. A complete 132 kV outdoor switching station, including twelve 2,500 MVA oil circuit breakers, is on order for Meaford " B " power station, together with other outdoor equipment for this country and India. The largest transformers in hand are six 70,000 kVA 11·8/140·7 kV generator transformers for Uskmouth.

Speaking at a luncheon following the opening of the extensions last Friday Sir Harry Railing, chairman of the G.E.C., said that the extensions at Witton and at the Fraser & Chalmers Engineering Works, Erith, which involved altogether an expenditure of nearly £2,000,000, would enable the company *inter alia* to produce electrical equipment for at least two or three more complete power stations a year. This allocation of a considerable part of its available capital resources provided a good example of the risks which the manufacturing industry continuously had to take.

Increasing Productivity

The company had urged before the end of the war that the nation's most pressing need, if productivity were to be increased, was for an adequate supply of electricity. It was a matter of great misfortune, that in spite of continuous pressure both by the manufacturing industry and by the British Electricity Authority, the late Government did not likewise realize early enough that adequate coal and electricity formed the very basis of the defence and economic programmes and that without them these programmes were impossible of fulfilment.

Sir Henry Self, deputy chairman of the British Electricity Authority, paying a tribute to the company's vision and enterprise, said that the opening of the extensions represented a milestone in free enterprise in its rightful sphere. He stressed the difficulties and inevitable delays in obtaining power station sites and said that it was essential to the long-term solution of the electricity supply problem that the " all clear " should be given to the extension of the generating station programme (at present sanctioned only up to 1955) and that the rate of installation of new plant should be stepped up from the present 1,000 MW to 2,000 MW a year.

Wakefield Inquiry

THE public inquiry opened at Wakefield Town Hall on 7th November into objections to the erection of a £12 million power station in the Wakefield area. Mr. E. Blain, representing the British Electricity Authority, said that if permission was given to proceed with the building work, the station would be operating by 1955 and load-shedding in the district would be a thing of the past. The majority of the objections were from people living in the villages surrounding Heath Common, who feared that one of the few remaining beauty spots in the district would be spoilt, and were also concerned about the possible effects of dust and grit. The Ouse Rivers Board felt some concern about the raising of the temperature of the River Calder and its effect on fish. Mr. Blain said that the intention was that the main buildings, four generators, four boiler units, and two reinforced concrete cooling towers should be near the Belle Vue locomotive sheds, the industrial part of Wakefield, and it was submitted that there could be no claim that the plant would obstruct a pleasant view. Modern " arrestors " would absorb 97 per cent of dust and grit. A new bridge was to be constructed over the main Doncaster road for the purpose of carrying coal to the station, which proposal had already been approved by both the Transport Commission and the Ministry of Transport. The plan had also been accepted by Wakefield Corporation and the West Riding County Council with provisos which the B.E.A. had agreed to meet. On hearing this public reassurance, Mr. H. Birch, representing the County Council, left the inquiry. It was stated that an increase in power consumption was anticipated by 1955–60, and a 25-mile survey of land flanking the River Calder had revealed no suitable alternative site.

Power Station Earthing

Factors to be Considered

THE chief factors governing the layout of earthing and banking networks in power stations and substations with a view to standardization are surveyed in a report prepared by Messrs. E. A. Beavis and A. C. Brocmank (*Engineering Bulletin*, Nos. 257/8, March/May, 1951) for Siemens Bros. & Co., Ltd.

Efficient earth connection entails consideration of: the nature and resistivity of surrounding soil and the presence of any corroding agents; availability of natural earths, e.g., water pipes and buried cables; value of earth resistance required; maximum fault current to be carried by the electrode and its time period; limitation of voltage gradient at the ground surface.

Connection Between Electrodes

After detailing methods of calculating soil resistivity and total earth resistance, the authors discuss the advantages and disadvantages of various types of electrode. They then give reasons for the view that neutral earthing circuits of high and medium voltage circuits in a power station should not be entirely dissociated from one another or from the station bonding (carcase earthing). With no common connection between earthing electrodes, a fault on one system could cause a dangerous voltage rise on another. Since the electrodes might then be in series, their resistance could be high enough to reduce fault current to an extent that would cause inefficient operation of circuit-breaking devices. The earthing systems should be interconnected either at the electrodes through underground cable or by running cables from each electrode to the main station earth bar. Connections to electrodes should be treated as live cables, especially in regard to good contacts at joints.

Fault current returning to the station by water pipes may raise their electric potential unduly unless they are well bonded to the carcase earthing system. Circulating currents between parallel electrodes should be prevented as far as possible to avoid electrolytic effects. The most suitable type of electrode will depend largely upon the soil resistivity and space available. Several electrodes may be necessary to obtain the requisite low value of earth resistance and to provide sufficient capacity for the maximum fault current, as determined mainly by the generating kVA. At least two separate main cables, each capable of carrying full fault current, should be run directly from different points of the carcase earthing network to the electrode system.

The main earthing system comprises a skeleton busbar framework within the station built up of various sizes of copper graded to meet the power available in different parts, so that local fault currents do not cause undue temperature rise or voltage drop. Thus the main bars run near large power units and switchgear, and the secondary bars near smaller units, with separate cables for light motors.

Authors' Recommendations

The authors' chief recommendations for an earthing busbar system are as follows: individual earthing leads for generator and transformer neutrals; a common ground-floor busbar of low resistance with extended earthing points distributed round the system; earthing bars " surrounding " each voltage system, linked together and connected to the ground busbar, or, alternatively, an earthing busbar on each floor connected by vertical bars to the ground busbar; a secondary busbar behind each switchboard to facilitate bonding to switches and instruments separately; individual bonding of the frames of large generators and motors and transformer tanks to the main busbar; earthing structural steel and crane rails to the main busbar.

In general for major stations the total resistance to earth should not exceed one ohm and for minor stations five ohms. With power stations of very large capacity an electrode resistance of only one ohm can give rise to a high voltage to earth under fault conditions unless appreciable neutral resistance is interposed or Petersen coil protection is in use on the cable system.

Testing Protective Equipment

I.E.E. Measurements Section Discussion

AT a meeting of the Measurements Section of the I.E.E. last week Mr. H. S. Petch opened a discussion on the measurements involved in the testing of protective equipment. Most of the fourteen speakers who took part in the discussion favoured the full-scale testing of protective equipment, but the difficulty in providing bulky test gear on site was acknowledged, and the works test was recognized as a compromise solution. In the latter case only a full and rigorous test up to the maximum specification of the gear would ensure that there remained the margin later to be absorbed, perhaps unobtrusively, by the growth of the system.

Tests conducted during the design and manufacture of the equipment, variously termed " type," " component," or " manufacturer's " tests, should be complete and exacting, and a speaker added that the testing of a completed assembly of individually-tested components should not be overlooked. Another speaker explained the interpretation of complex oscillograms taken by manufacturers. In the subsequent testing of protective equipment, dependable operation and a consistent factor of safety were, in the view of one speaker, of greater importance than refined measurements of accuracy greater than, say, 3 per cent, and comparative figures might be as informative as absolute values obtained by complex methods.

Simpler Methods Preferred

Similar views were held regarding maintenance or routine testing. The simpler methods were favoured, with the provision of links, switches or sockets to facilitate such testing, a preference being expressed for switches and sockets on the grounds that links introduced the possibility of poor connections and were slower, or even impossible, to manipulate in some situations. The installation of instruments, such as mains-operated " Megger " insulation testers, at a central testing position, could be useful and in some circuits alarm bells could be introduced.

An electronic timing meter had been demonstrated at the opening of the discussion and a speaker reported the successful use of such instruments in the testing of circuit-breakers. A device for measuring longer time intervals of several seconds, also demonstrated, used a vibratory motor. This received favourable comment as being free from time lag or idle motion and superior to the phonic motor for the purposes under discussion.

It was noted that instrument transformers which gave accurate results with meters did not necessarily perform as satisfactorily with relays, and loss of accuracy of rectifier instruments on " peaky " waveforms was remarked upon during the discussion.

Some speakers favoured the setting up of a maintenance schedule in the light of data obtained at commissioning tests. Others preferred a flexible schedule in which the intervals of maintenance could be lengthened in the case of gear showing a good record. One speaker noted that where maintenance entailed visits from a distance all the equipment at the site would be attended to without regard to individual schedules.

Preventive Maintenance

The value of preventive maintenance was appreciated, with the proviso that frequent disturbance of the gear, and tests of an unnecessarily severe nature, were unjustified. One speaker enquired about maintenance work on contacts and it was felt that the same remarks applied.

The opening speaker had suggested 5 kV as a test figure for insulation against stray earth currents; 10 kV was quoted in the discussion, together with a description of a test method using a metal barrier, or floating earth strip, between layers of insulation. Another method suitable for cable glands employed a milliammeter with a current transformer around the cable sheath. When the cable was injected, any current differential was indicated.

Experiments similar to those initiated by

the E.R.A. were reported, in which the wiping of a continuous magnetic tape would automatically cease on receipt of signals denoting the operation of protective gear. The record of the signals would thus be retained for play-back and study.

The provision of testing windings on current transformers was considered a waste of copper space and capable of giving incorrect results in the event of a winding defect, although auto-transformer connection would obviate part of this objection. Secondary injection methods of testing were not favoured as they necessitated knowledge of frequency and waveform and departed from the direct and simple methods already commended. Similarly, a suggestion that the performance of apparatus might be predicted from a consideration of the parameters of the components, as in communication engineering, was not generally supported.

Interest was shown in a suggestion that a spare induction relay might be maintained as a standard to be run in series with one under investigation. The performance of the latter would then be measured by a simple comparison of disc travel, without reference to waveform or frequency.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Alternator Demagnetization

WHEN commenting in your issue of 12th October on the article by Dr. T. F. Wall (31st August) wherein he described the principle underlying an unusual method of demagnetizing large alternators, I had three objects in view. In order of importance, they were first to emphasize that the opening of the main field switch would not be accompanied by such dire consequences as suggested in the opening paragraphs of the article, and that this method of demagnetization may, in fact, be considered standard British and American practice. Secondly, to point out that the total time of demagnetization is by itself not a criterion of efficacy, since it is very dependent on conditions unconnected with the field suppression method used. Lastly, to question the claim for maximum simplicity for a scheme which incorporates a highly stressed d.c. machine in contrast to static apparatus used with some alternative arrangement; for example, the robust metallic grid discharge resistance of a field breaking switch.

I feel that no further remarks are called for on my first point, but the second is of importance if a satisfactory basis of comparison between different methods is to be established. As an example, a time of about one second to reduce the flux of a large turbo-alternator to 10 per cent of its original value has been obtained from oscillographic tests, using a plain field breaking switch and with the stator windings short-circuited, i.e., under fault conditions. The corresponding time with the stator windings open-circuited was about 15 seconds. Since the conditions under which Dr. Wall's tests were made are not known one cannot state whether his results are approximately equal to those obtained with a plain field breaking switch, or are very much inferior.

There is another aspect of efficiency which must be considered; the maximum rate of extraction of energy from the field should occur as soon as possible after demagnetization is initiated so that the amount of energy available to cause damage at the fault is also reduced as quickly as possible. These conditions are obtained with a field breaking switch, but with Dr. Wall's arrangement dissipation of energy presupposes rotation of the d.c. armature and, since a finite time is required for acceleration, the maximum dissipation of energy will occur somewhat later. Thus the energy at the fault is maintained at a high level for a longer period and greater damage would be expected.

Referring to my third point, the further details given in Dr. Wall's letter (19th October, p. 791) are interesting, but could hardly be deduced from Fig. 2 of his article which specifically refers to rotor demagnetization. In this figure switch *S* is opened (not closed) to de-excite the

machine; no indication is given, in the diagram or the text, of the method used to effect the change-over of the connections of the d.c. armature and the rotor from series to parallel, and the simultaneous disconnection of the supply to prevent it also being short-circuited through the armature.

In the foregoing, fault conditions have been mentioned because I cannot agree that the problem is unconnected with faults or general power station operation. Surely, the number of emergencies arising which make the rapid demagnetization of the alternator desirable and are not related to faults, or do not cause operation of the protective gear, must be very small. In normal circumstances, when time is not important, an alternator should be demagnetized by gradually reducing the field excitation, so avoiding unnecessary application of overvoltage to the excitation circuit insulation.

Birmingham. V. EASTON.

An Unwanted Position

THE complaint voiced under this heading in your issue of 2nd November can be traced to two causes. First there is safety, or to give it its other name superannuation: that is the offer by a company of a pension at the end of so many years' service.

When a man has paid into this for some years he is loath to lose the benefits which have accrued, so he would rather have the poorly paid job he has than step out for the higher paid job and be responsible for saving his own pension out of the extra money he could command.

The second cause is the fact that immediately a man's age is stated as being over thirty-five years his application is discarded, because the firm wants a man who will be in the job for a long time, irrespective of the fact that an older man will have greater experience and be more settled in his job. If employers gave older men a chance when they applied for a situation, they would find, to their surprise, that these men had a much greater interest in the welfare of the business.

" S. T. U. DENT."

Is Electric Water Heating a Luxury?

MR. Wyndham Roberts, in his letter in your issue of 19th October regarding the recent Combustion Engineering Association Conference, refers to " the value of the water heating load." Presumably he was referring to the value to the B.E.A. So far as they are concerned this load is doubtless valuable; it does not probably materially contribute to peaks and it improves load factor.

The point, however, in the various speakers' minds at this conference was the value of electric water heating to the national well-being, and this is negative. It is impossible to heat water from the grid with an overall efficiency greater than 19 per cent. It is possible to heat water by gas or in a solid fuel boiler with an efficiency of 40–80 per cent, dependent on the cost and design of the appliance.

Probably no-one wishes to prohibit the use of electricity for space and water heating because its convenience and cleanliness are outstanding, but it is a luxury. The purpose of the conference was to discuss " Meeting the Fuel and Power Shortage," and, in my opinion, it is a luxury which the country cannot afford at the present time.

Luton, Beds. B. E. A. VIGERS.

Technical Writing

A LUNCHEON was arranged at the Café Royal, London, W.1, by the Radio Industry Council, on 12th November to inaugurate a scheme for premiums for technical writing. Mr. J. W. Ridgeway, O.B.E., chairman of the R.I.C., presided and the other speakers were Mr. E. M. Lee, Mr. W. M. York, Professor Willis Jackson and Sir Ernest A. Gowers, G.B.E.

The purpose of the scheme is to encourage the writing and publication of articles reporting technical progress and development in radio and electronics in Great Britain. As from 1st January next the Radio Industry Council will award premiums of 25 guineas each, up to an average of six a year, to the writers of published articles which, in the opinion of a panel of judges, deserve to be commended by the industry. It is hoped that this will gradually increase the number and standard of articles available to editors. Only " non-professional " writers are eligible for awards.

Writers and editors will be invited to submit published articles to the Secretary, Radio Industry Council, 59, Russell Square, W.C.1 (five copies if possible) but the judges will also consider unsubmitted published articles.

The judges are Mr. E. M. Lee, Mr. W. M. York, Mr. T. E. Goldup, Vice-Adm. J. W. S. Dorling and Professor Willis Jackson; they will have the advice of the editors of the *Wireless World* (Mr. H. F. Smith) and *Electronic Engineering* (Mr. H. G. Foster).

Commerce and Industry

European Aluminium Production

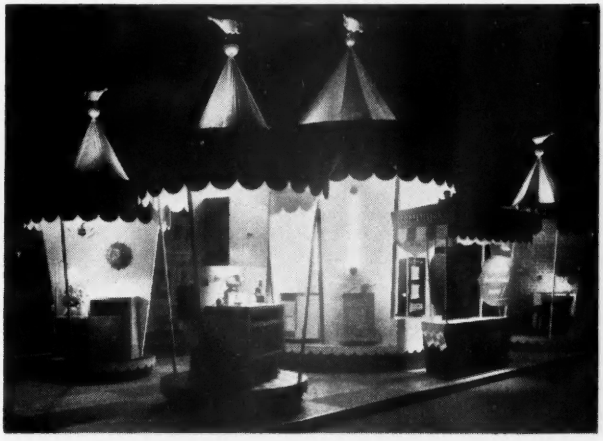
Rise in German Export Trade

THE Council of the Organisation for European Economic Co-operation has invited member countries to take steps to provide increased supplies of electricity for the production of aluminium. In 1950, Western Europe could only use some 45 per cent of her productive capacity for aluminium because of electric power shortage. The situation improved this year as the abundant rainfall increased the output of hydro-electric stations, and it appears from first estimates that three-quarters of available productive capacity has been used. If all the available plant could be used, member countries of the Organisation would be able to provide from their own resources a great part of their 1952–53 aluminium requirements, estimated at 500,000 tons.

The O.E.E.C. Council is addressing an urgent appeal to member countries asking them to assist aluminium factories to work at full capacity by providing them with sufficient power at economic rates. They are asked to ensure that power produced by stations set up specially to serve aluminium producers should not be put to other uses.

Glasgow Modern Homes Exhibition

Under the theme "New Lamps for Old" the South West Scotland Electricity Board's stand at the Modern Homes Exhibition held at Kelvin Hall, Glasgow, provided a gay and colourful spectacle. The effect was achieved by the representation of a country fairground, complete with stalls and roundabouts, each with its golden, floodlit canopy topped by the traditional Aladdin's lamp. To complete the fairground impression, the four corner units revolved continuously. Against this bright and animated background the special displays to emphasize the value of efficient lighting in the home were extremely effective. Well-designed lighting fittings were exhibited on the rotating units in surroundings which gave the illusion and atmosphere of various parts of the modern home, including the nursery, porch and garage. A feature which proved popular was a "Stillograph Machine" used to illustrate a selection of the best entries in a children's painting competition organized from the Board's service centres. The children whose paintings were on show were given a special invitation to attend the exhibition and bring their parents to see the stand.



The stand of the South West Scotland Electricity Board at the Glasgow Modern Homes Exhibition

Large Sound Equipment Installation

One of the largest industrial sound equipment installations in Great Britain has recently been supplied to John Player & Sons, of Nottingham, by the General Electric Co., Ltd. The installation consists of four 500 W high fidelity amplifiers, which feed "Music While You Work" programmes into some 500 loudspeakers distributed throughout the works. About forty-two miles of wire was required, with a main 100-way cable leading up from the control room. The eighty loudspeaker circuits are grouped up and paralleled across the amplifier outputs but there is also an elaborate cross-connection panel whereby any given loudspeaker can easily be connected to any amplifier. This arrangement

allows changes to be made as a result of departmental expansion or rearrangement.

An interesting feature of the installation is that it is linked to a small 60 W amplifier, which feeds twenty-four loudspeakers, in a works situated in another part of Nottingham. The small amplifier is remotely controlled from the main installation and input is taken from the main equipment, over lines rented from the Post Office, the level being attenuated to the point required by that authority.

Minister at F.A.S.S. Luncheon

Mr. David Eccles, the new Minister of Works, will be the principal guest at the luncheon of the Federation of Associations of Specialists and Sub-Contractors at Grosvenor House, W.1, on 29th November. He will reply to the toast of "H.M. Government."

German Electrical Trade

During the first half of 1951 West Germany's export trade in electrotechnical products (including machinery) rose in value to Dm. 285,000,000 against Dm. 108,200,000 in the corresponding period of 1950. Contiguous countries in Europe were predominant customers while other Continental countries such as Turkey and Greece figured as good outlets for a number of lines.

The expansion in trade was noticeable in all the main groups and particularly in those including apparatus for lighting and power transmission in which good business was obtained in Egypt, Persia, Indonesia and Malaya as well as in several South American countries. A threefold increase in exports of large dynamos, motors, etc., was partly attributable to bigger contracts in South America, India and Iran.

Trade in radio goods, radio-gramophones and allied lines showed a big advance; Turkey, the United States, Sweden, Greece, Persia and Argentina were among the countries of destination. Electro-medical apparatus was sent in bigger quantities to Argentina, Brazil and Hong Kong as well as various European countries.

Imports into Germany of electrical goods during the half year showed a small increase but were only about a tenth the value of exports.

Cooking Demonstrations

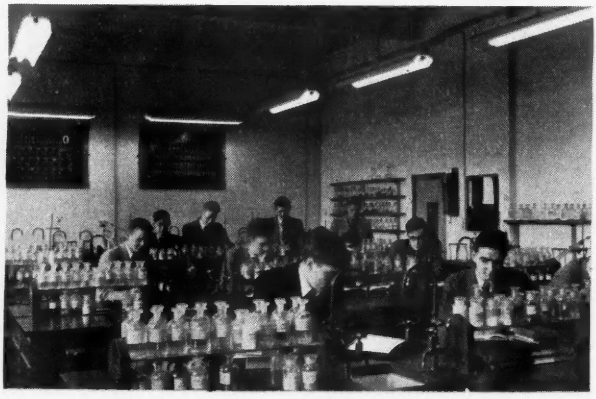
Mr. Philip Harben, the B.B.C. television chef, was engaged recently to give cooking demonstrations at Dorking and at Surbiton. Arranged by the Surrey Sub-Area of the South Eastern Electricity Board, the demonstrations were held in support of the "new cookers for old" campaign and each attracted an appreciative audience of about three hundred. The E.D.A. film "Boiling and Simmering" was shown. Both shows were very well received.

Modern School Lighting

Numerous schools in the South Wales region have been equipped with modern lighting schemes in recent months and considerable appreciation of the value of well-planned illumination is shown by both architects and local authorities in this area.

Particularly fine examples are to be found in the new Malpas, Maesglas and Gaer schools, all designed by Mr. Johnson Blackett, F.R.I.B.A. The buildings are remarkable for economy of space, the provision of amenities from surgeries to parents' waiting rooms, and for spacious and bright surroundings created by the decoration and lighting. There is a complete integration of lighting with decoration and general architecture. In the corridors, for instance, spherical tungsten fittings alternate with inlet ceiling windows, so that maximum light, whether natural or artificial, is always available. Spherical tungsten fittings give a diffused and warm light in the two halls and in waiting rooms and canteens. In the classrooms "Mazda" fluorescent fittings are installed. Fittings are placed, and lamps chosen, in relation to the design of the rooms and the pastel shades used in decoration, so that the light is evenly distributed.

Another good example is provided by the



"Mazda" fluorescent fittings in the chemistry laboratory of Newport High School for Boys

Newport High School for Boys where "Mazda" fluorescent fittings of various types are employed. Laboratories and lecture rooms are extremely well served by lighting which enables both detailed experimental work and chalkboard instruction to be carried out without reflections, shadows and other distractions. Chalkboard lighting is here provided by special angle-reflector fluorescent fittings. In these and many other schools in South Wales where modern lighting has been installed, the emphasis is on careful planning for each separate room and on uniformity of illumination.

Export of Copper Goods

From 8th November the export of some copper goods to any destination, other than China or Hong Kong, under open general licence will be permitted only if the value of the goods exceeds the value of the copper or copper alloy content, calculated at the rate of £700 per ton for copper and £600 per ton for alloys mainly of copper. This licence applies to goods specified in Group 6 (2) of the First Schedule to the Export of Goods (Control) Order, 1951.

Control Unit Sales Aid

The latest publicity material issued by Arrow Electric Switches, Ltd., takes the form of cut-outs for their range of indicating control units. These sales aids are attractively prepared in red and blue with white lettering and edges. They take the form of an arrow which fits on to the units. Two types are available, one for the tumbler unit and the other for the horizontal rotary pattern. Wholesalers and distributors can obtain this material direct from Arrow Electric Switches, Ltd., Hanger Lane, Ealing, W.5.

Showcard issued by Arrow Electric Switches, Ltd.

B.I.F. Exhibitors

The annual meeting of electrical exhibitors at the British Industries Fair, Castle Bromwich, was held in Birmingham on 7th November. The report of the Electrical Exhibitors' Committee was presented and adopted. It mentioned a number of matters in connection with the arrangements at Castle Bromwich upon which it had approached the Fair management. Among these were catering facilities for exhibitors' staffs during the week of preparation before the opening of the Fair and the limitation of the height of stands to 11ft 3in. A number of exhibitors considered that a maximum height of 12ft 6in should be permitted and some of them again advocated double-tier stands as a means of providing office space separate from the exhibits.

Mr. W. Percy McGeoch was re-elected chairman of the Committee and Mr. W. T. Litchfield as vice-chairman; the Committee was re-elected *en bloc*.

Impulse Generator

We are asked to clarify the term used by the makers to describe the tanks which contain the transformer, capacitors and other parts of the Johnson & Phillips impulse generator described in our 2nd November issue. They are in fact enclosed in Paxolin synthetic-resin-bonded paper cylinders manufactured by the Micanite & Insulators Co., Ltd.

Film on Laminated Wood

On Tuesday and Wednesday this week Permali, Ltd., showed the film "Strength Where You Need It," at the Café Royal, Manchester. This film, which shows some of the many uses of "Permali" laminated impregnated "densified" wood, was exhibited in London in November last year and was reviewed in our issue of 24th November, 1950.

Ex-Edmundsons Reunion

It is proposed to hold a reunion of former employees of Edmundsons Electricity Corporation, Ltd., on 8th February next at the Holborn Restaurant, London, W.C. Tickets, 16s 6d each (covering gratuities but not drinks) are obtainable from Mr. R. H. Sharman, Room 233, British Electricity Authority, Winsley Street, London, W.1.

British Engineers' Association Luncheon

Mr. D. D. Walker (Eversheds & Vignoles, Ltd.), president, took the chair at the annual luncheon of the British Engineers' Association at the May Fair Hotel, London, W.1, on 8th November. About 230 people were present and Field Marshal Sir William Slim, G.C.B.,

G.B.E., D.S.O., M.C., Chief of the Imperial General Staff, was the principal guest. Apart from the loyal toast, "Our Guests" was the only toast. It was proposed by the president and responded to by Sir William Slim, who suggested that manufacturers should, if anything, over-estimate delivery periods rather than display excessive optimism. Mr. Beharrell, who is the president of the Society of Motor Manufacturers & Traders, Ltd., also replied to the toast.

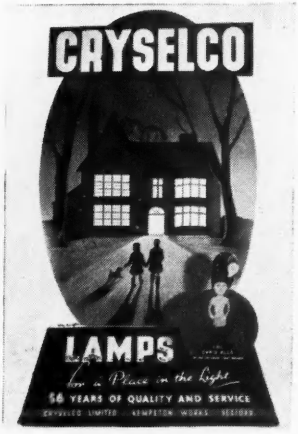
A vote of thanks to the president was proposed by Mr. H. S. Broom, M.B.E., vice-president of the Association.

Restriction on Glassware Imports

Following the announcement by the Chancellor of the Exchequer about the need for restricting imports a number of amendments have been made in the Open General Licence now in force. The only specifically electrical item included in the list of amendments is that relating to lighting appliances. This item has been amended to permit the general importation only of lighting appliances and fittings not containing pottery or glassware.

Lamp Publicity

A large centre-piece with wings, stressing the importance of lighting in the factory and in the home, is one of the main items of lamp publicity which Cryselco, Ltd., has prepared for the 1951–52 season. The company has also produced a smaller showcard depicting lighting in the home, while the "Col. Chris Elco" cut-outs for counters and small display cabinets have been revived. An up-to-date catalogue is being issued, together with attractive general and automobile price lists. Broadsheets are also being circulated incorporating the total price, including purchase tax, for quick reference by retailers.



New lamp showcard produced by Cryselco, Ltd.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £124 0s 0d
COPPER, H.C. Electro	ton £227 0s 0d
Fire Refined 99·7 per cent	ton £226 0s 0d
Fire Refined 99·2 per cent	ton £225 10s 0d
COPPER Tubes	lb 2s 2d
Sheet	ton £277 10s 0d
H.C. wire and strip	ton £254 0s 0d
LEAD, English	ton £176 10s 0d
Foreign	ton £175 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £980 0s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £194 0s 0d
BRASS Tubes	lb 2s 1d
Sheet	lb 2s 4½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE	
Wire	lb 3s 6½d
RUBBER, No. 1 R.S.S. spot	lb 43½–43¾d

Trade Announcements

Mr. J. L. Lovell has been appointed agent in the South West area for **William McGeoch & Co., Ltd.** He will operate from 3, Hazelton Road, Bristol, 7.

High Duty Alloys, Ltd., announce that the address of their northern area sales office is now Colwyn Chambers, 24, Mosley Street, Manchester, 2 (telephone : Manchester Central 2758).

Catalogues and Lists

British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.—Four catalogues dealing respectively with television downlead cables, mining type straight joint boxes, aluminium sheathed cables and terminal boxes for telephone and auxiliary circuits.

Corrosion, Ltd., 351, Coastal Chambers, Buckingham Palace Road, London, S.W.1.—Technical brochure on "Furnascote," a new range of refractory coatings for furnaces, boilers, etc.

Thomas De La Rue & Co., Ltd. (Plastics Division), Imperial House, Regent Street, London, W.1.—Technical brochure containing electrical and mechanical data on "Delaron" laminated plastic.

Ashley Accessories, Ltd., Morecambe Road, Ulverston, Lancs.—Illustrated folder on electrical accessories.

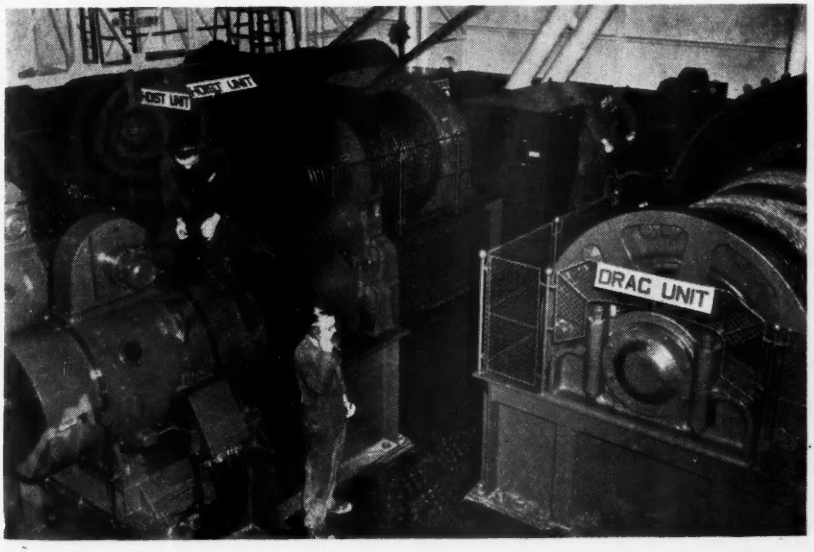
Thorn Electrical Industries, Ltd., 105-109, Judd Street, London, W.C.1.—Catalogue of "Atlas" fluorescent lighting fittings.

Large Excavator

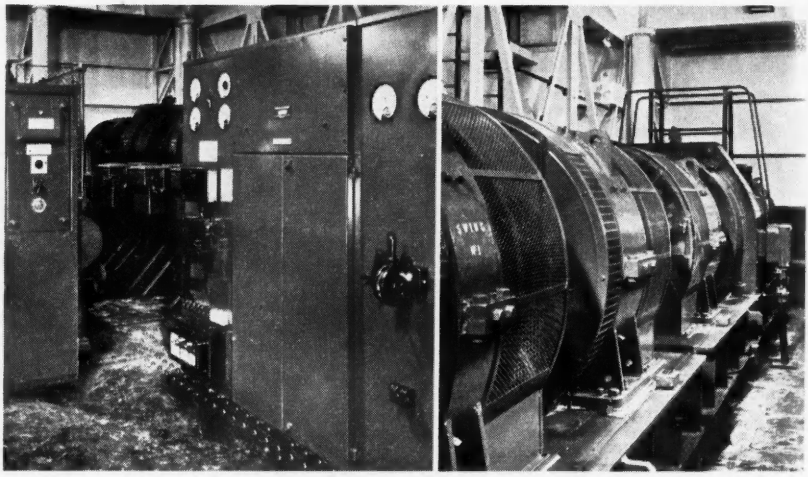
Main Electric Drives and Control Gear

A LARGE excavating machine of the "walking" type, with a dragline bucket which weighs 22 tons and digs about 27 tons at a fill, has been installed at one of the ironstone quarries of Stewarts & Lloyds, Ltd., near Corby in Northamptonshire. The machine weighs 1,600 tons and has a dumping radius of 260ft; the head of its jib, 175ft above ground in its working position, moves at a rate of nearly 23 miles/hr when slewing.

The machine "walks" on two "shoes," one on each side, each 48ft long, 9·5ft wide and weighing 56 tons. The 282ft long jib was constructed on site of steel tubes welded together; some 18,000 electrodes weighing 2 tons were used by two welders with two mates, while only eleven men were



The great jib of the W.1400 walking dragline ironstone excavator. *Below:* **This part-view inside the cab affords an idea of the size of the main machinery deck**



One of the duplicate main 1,200 kVA motor-generator sets. Motor-generator starting gear with synchronous motor power factor control panel on left

employed in constructing the jib on site. Its design was evolved by Tubewrights, Ltd., a subsidiary of Stewarts & Lloyds, Ltd., in collaboration with Ransomes & Rapier, Ltd., who had the overall responsibility for the machine. Some 32 vital welds in four 10in tension members were radiographed with Stewarts & Lloyds' mobile X-ray equipment and also examined with gamma-rays produced by radio-active isotopes.

Because of the height of the boom-head when in the working position, it is fitted with warning beacons as an indication of danger to low-flying aircraft at night. Filling the bucket, hoisting it 100ft, swinging round to the discharge point, emptying the bucket and returning it to the digging position occupies little more than one minute. The machine can walk under its own power in steps of 7ft at a time, moving at an approximate rate of 200 yd an hour.

Electric drives were the only convenient means of achieving the performance of which this excavator is capable. Electricity is delivered to the site by two 33 kV overhead power lines from the switch-house at Corby which is connected by 0·15 sq in 3-core 33 kV screened s.l. and s.w.a. cables to the H-type terminal poles of the overhead lines adjacent to the Corby works 132 kV substation. There are two separate single-circuit overhead lines, each approximately 4,100 yd long, of 0·15 sq in copper conductors, erected by the Contract Department of W. T. Henley's Telegraph Works Co., Ltd. Stewarts & Lloyds supplied the tubular steel supports which are equipped with Henley cross-arms. Each line has a continuous galvanized steel earth wire and on one line it is heavier and supports a 14 by 3/0·036 plus two by 1/0·036 screened pair 660 V aerial pilot and telephone cable.

The lines terminate at Weldon Lodge substation where the voltage is stepped down to 6·6 kV and a p.i.l.c., s.w.a. land cable for that voltage is laid on the ground surface so that it can be moved about as required to avoid risk of damage by quarrying operations. Ellison plug boxes are inserted in the cable at intervals of a few hundred yards. The stepped-down power is delivered to the machine through two trailing cables at 6·6 kV, which is unusually high for this kind of work. These cables were specially designed and manufactured by Henley's for the purpose. They are of the four-core pliably-armoured t.r.s. flexible type of 3·74in diameter overall. Each 500ft length weighs 48 cwt.

British Insulated Callender's Cables, Ltd., supplied upwards of 9,250 yd of various sizes of v.r.i. steel wire armoured

and compounded 660 V cable for the project.

The trailing cables enter the "tub" of the excavator through two oval openings near the base, terminating in slip-ring collector gear on the centre post about which the cab rotates. The cabin has two decks, with a floor area equivalent to that of two tennis courts, with the main machines on the upper deck. Incoming power goes into two main switching cubicles whence it divides through independent isolating switches for the two main motor-generator sets, a 200 kVA, 3-phase, 6,600/440 V auxiliary transformer and a 50 kVA, 3-phase, 6,600/110 V lighting transformer.

The duplicate B.T.H. motor-generator sets are resiliently mounted across the tail-end of the main structure. Each set is driven by a 1,200 kVA unity power factor at 1,000 r.p.m. synchronous motor and consists of a 400 kW 550 V hoist generator, a 400 kW 550 V drag/walk generator and a 200 kW 275 V swing generator. These machines are solidly coupled and run in five oilring lubricated pedestal bearings with a self-aligning single-row ball bearing incorporated at one end to take the thrust.

An auto-transformer using a single hand-operated oil circuit breaker is employed for starting each set and the change-over from tap to line is accomplished through an air-break rotary switch operated from the circuit breaker handle.

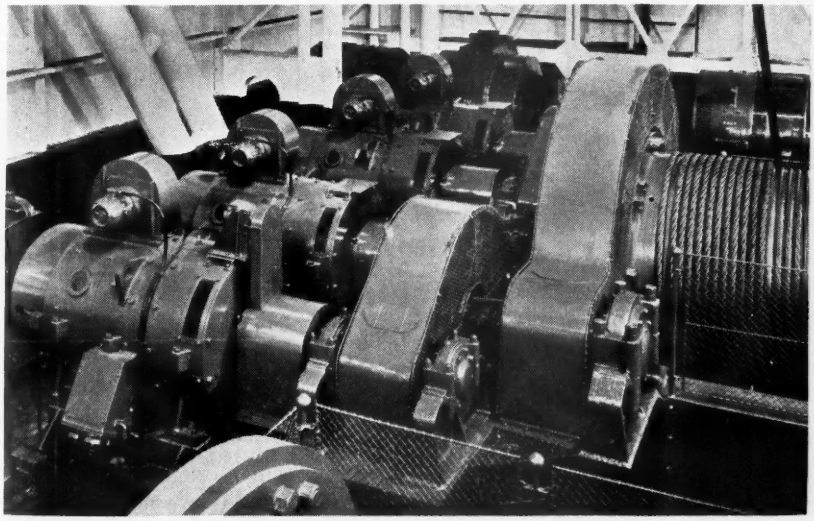
Two identical motor-driven exciter sets are installed, one of which is maintained as a standby. Each set has a 95 h.p. induction motor driving a 56 kW 125 V constant-voltage exciter for the d.c. motors and generators as well as a 17 kW 45 V machine for exciting the synchronous motors. An amplidyne is also included to control the field of the synchronous motor exciter so as to keep the power factor of the main synchronous motors at any desired value from unity to 0·8 leading, irrespective of load variations on the main motor-generator sets.

A separate motor-driven amplidyne generator set is provided for the control of the hoist, swing, and drag/walk generators.

Hand-operated oil-immersed star/delta starters are used for the exciter and main amplidyne sets and are conveniently placed close to the main synchronous motor starters.

The hoist, drag, and walk motors are each driven by four 225 h.p. 230 V 450 r.p.m. separately-excited, shunt-wound, heavy duty motors. They operate in tandem and are connected in pairs, in

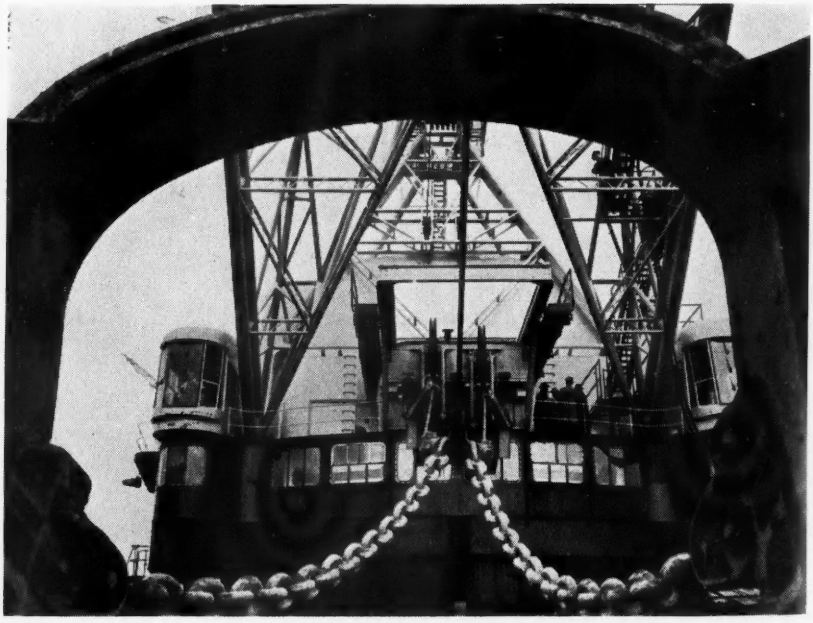
Four dragline hoist motors with motor-generator in background



series, across each of the hoist and drag/walk generators. The walk motors take their energy from the same generators as the drag motors, as only one of these motions would ever be in operation at a time. A motor-driven rotary switch is provided for changing over the armature and field connections and is remotely controlled from either control console. All the main driving motors are individually forced-ventilated by separate motor-driven blowers. Two 225 h.p. motors, one energized from each swing generator, drive the slewing motion. They are vertically mounted on top of their respective gearboxes, but, electrically, they are of the same design as the hoist, drag and walk motors.

The whole machine is controlled by one man from either one of two control cabins situated on either side of the superstructure at the front, and level with the bottom of the boom. Each cabin houses an almost identical control console. Three cam-operated master controllers are situated behind the seat of the console and are operated by a link mechanism from the two vertical levers for the hoist and drag/walk motions and from the pedals for the swing motion. Along the right-hand arm of the console are the three pistol-grip two-position switches for the brakes on the various motions, and another similar switch for changing over from drag to walk; indicator lamps suitably inscribed show when the motor-operated changeover switch has actually completed its travel and changed over the supply to the motors required. Tumbler switches are also incorporated to control the various floodlighting circuits (through contactors where necessary) to enable the machine to work at night. A central-zero meter at the front of the arm, scaled in ft/min, is coupled to a tacho-generator and gives the driver an indication of the speed of the hoisting line. Another indicator shows the driver when the walking shoes are fully raised into their normal working position. The left-hand arm has an exciter voltmeter, emergency stop and reset buttons at the front, followed by the port/starboard changeover switch

View through arch of bucket scoop, showing machinery cabin and driver's cab on each side



and indicator lights. Finally there is a meter to show how many of the four aircraft warning lights at the boom head are actually alight, together with the switch controlling those lights. All these controls are duplicated in the other cabin with the exception of the port/starboard changeover switch.

The auxiliary B.T.H. machinery on the excavator comprises a 25-ton electrically-operated overhead travelling crane in the machinery house with two 10 h.p., one 5 h.p. and two 2 h.p. motors energized from the 125 V exciter sets. There is also an auxiliary hoist gear for raising the boom; it is driven by a 50 h.p. slip-ring type of motor with "Stacreep" control to ensure precision speed regulation when hoisting and lowering the boom.

All the machines and control cubicles are fitted with electric heaters supplied from the 200 kVA transformer and they are automatically switched on by a contactor to guard against condensation in damp weather when the rest of the equipment is shut down. They are arranged in three equal groups of about 10 kW each.

South Eastern Board's Policy

Meeting with Manufacturers' Representatives

THE eighth of the series of half-yearly meetings between manufacturers' representatives and members and officers of the South Eastern Electricity Board was held at Brighton on 8th November. Mr. W. R. T. Skinner, deputy-chairman of the Board, presided, as usual, and in his opening remarks said that it was evidence of the increasing popularity of the meetings that the attendance was 235, against 186 at the last meeting.

Since that meeting there had been alterations in the Board's purchasing arrangements—a subdivision of central purchases between the engineer's, chief commercial officer's and secretary's departments. This did not mean that there was to be any greater centralization of purchasing than before; the Board still wished manufacturers to maintain contact with its five Sub-Area and 35 District offices by which the bulk of orders would continue to be placed.

Referring to the Board's recently published third annual report, Mr. Skinner said that it stressed the necessity of ensuring that power station construction and the equally important reinforcement of distribution systems were not delayed by "artificial" means, such as restriction of capital. But even without artificial restrictions it was possible that the rate of the Board's progress would be retarded by the scarcity of materials.

It must be realized that sufficient power was as important as sufficient raw materials; the power must come first so that available raw materials could be efficiently processed into finished products. They hoped to see a gradual expansion of the housing programme. In this case, too, a supply of electricity should be available immediately the houses were ready.

This led to the consideration of the provision of electrical appliances for the home. Most of these were subject to heavy purchase tax which should be removed, not necessarily at once, but step by step according to what was politic. Only thus could efficiency be improved in another sector of our domestic economy.

It was the Board's belief that a steadily expanding development of electricity supply in rural areas was essential to the country's sound economy and progress. They had continued to press on, so far as the normal limitations allowed, with the provision of electricity supplies to farms, provided that materials and equipment were available and that the appropriate County Agricultural Committees certified that electricity would increase food production.

The record of supplies to farms (not less than 5 acres in extent) was as follows:—1947–48, 370; 1948–49 (the Board's first year), 469; 1949–50, 535; 1950–51, 477. The rate of connection this year had been only fractionally below that of last year. The 7,500 farms now served represented about 60 per cent of the total in the Area, which they believed was as high a proportion as anywhere in the country.

Before inviting questions, Mr. Skinner asked manufacturers who were distributing information to notify headquarters if possible of the extent of circulation to avoid possible duplication.

Mr. Skinner was asked whether the B.E.A. intended to set up a central testing house for appliances; there was a possibility of variation of ideas if there were several testing establishments. In reply Mr. Skinner said he had no information on this point. The Board had its own testing arrangements. He did not favour a central establishment; the Board was constantly trying to avoid excessive centralization.

Answering another question, Mr. C. F. Wells, chief commercial officer, said that the Board had made the necessary arrangements to secure sufficient steel for its contracts.

Asked if the limitation of capital expenditure was likely to result in fewer appliances being available at the Board's service centres, Mr. Skinner said that sales might be reduced if capital restrictions prevented the connection of new consumers and limited hire-purchase.

He told another questioner that the Board had not made separate representations for the reduction of purchase tax but E.D.A., on behalf of the industry, had sent a memorandum on the subject to every M.P.

Thanking the manufacturers' representatives for their attendance, Mr. C. G. Morley New, member of the Board, said that on nationalization 14 or 16 "customers" had been substituted for five or six hundred. Naturally the manufacturers had had apprehensions but they found, so far as the South Eastern Board was concerned, that they were still able to discuss their problems with the same people. The immediate future was hazy but the Board hoped that it would get a fair share of the capital available.

Mr. C. Boyles, former purchasing officer to the Board, proposed a vote of thanks to Mr. Skinner. He said that the S.E. Board was the only one of the Boards to hold such meetings, which had proved very useful to the Board and to the manufacturers.

Navigational Aids

TWO orders for radio beacons, to be installed at sites which are completely opposite in climate, have been secured by Marconi's Wireless Telegraph Co., Ltd., one through their associated company, Amalgamated Wireless (Australasia), Ltd. Two beacons are to operate in the Antarctic and a fully equipped navigational station is to be erected in the tropics, at the "Penguin Shoals," off Western Australia.

The two radio beacons, which are Marconi Type RB.109, are being constructed for the Administration of the Falkland Islands Dependencies, and are primarily for the use of whaling fleets in the Antarctic. The stations are to be established on desolate uninhabited islands in the South Atlantic off the coast of South Georgia. They will provide half-hourly transmissions to enable vessels approaching the mainland to plot their positions by the intersection of radio bearings at ranges of up to 100 miles or so. On account of the difficult location of the sites the service will be entirely automatic, the stations being arranged to operate without attention for a period of three months under weather conditions of great severity.

The Australian contract has been obtained in the face of keen world-wide competition. The station, designed to comply with the special requirements of the Commonwealth Lighthouse Department, will be erected on Troughton Island and will provide high power m.f. beacon transmission by automatic time control and on "request," twin-channel h.f./d.f. facilities and h.f./m.f. communication with vessels and with the Department's telephone network and other coastal stations.

Scottish Contractors' Dinner

NEED to double power station construction and to double again in 1961 was urged by Mr. T. Lawrie, general manager of the North of Scotland Hydro-Electric Board, when he proposed the principal toast at the annual dinner of the Electrical Contractors' Association of Scotland (West of Scotland Branch) on 7th November. If we were to maintain agricultural production, our industrial position in the world and avoid frustration and drudgery in the home, more power stations were essential. Mr. R. D. M'Craith, president, referred to the hope that the new Government of experienced business men might effect an improvement in the industry's position. Mr. D. G. Lindsay proposed "the official guests" and Dr. Anderson, director Royal Technical College, replied. Mr. Fulton proposed the toast of the chairman.

ELECTRICITY SUPPLY

Injunction Sought Against Board

Scottish Industrial Tariffs

THE long-drawn-out controversy over the Midlands Electricity Board's plan to erect power lines across the Malvern Hills was taken a stage further last week. After a second public inquiry had been held, modified proposals were approved by the Minister of Fuel and Power, but the Minister insisted that underground cables must be used for 600 yards over the crest of the hills.

The National Trust, which holds covenants over a large section of the hills, has now issued a writ applying for an injunction restraining the Board from erecting lines on a 500 yd stretch of the hills. In a statement the Trust explained that it thought it essential that another 500 yd of the line should be underground. It recognized the urgent need for electricity in the district and wanted to help, provided it did not mean ruining the amenities of this stretch of the hills.

Mr. A. Stephens, secretary of the Board, said that the statutory provisions had been complied with and the Board was now going ahead with the construction of the line. The National Trust was represented at the inquiry.

Coal Stocks

The weekly statement by the Ministry of Fuel and Power shows that stocks of coal at power stations on 27th October last amounted to 5,256,000 tons, equal to six weeks' consumption. This compares with 4,290,000 tons (5·5 weeks' consumption) on 28th October last year. The corresponding figures for gas undertakings were 3,108,000 (4·8 weeks) on 27th October last and 3,083,000 (5·1 weeks) a year ago.

Standard Industrial Tariffs

The South West Scotland Electricity Board have approved standard industrial tariffs to replace not only the twenty-six published tariffs which at present apply throughout the Area, but also many special agreements under which industrial consumers are supplied with electricity. These new tariffs, which will be brought into operation on 15th December, are as follows: (*a*) A block tariff, on the basis of the first 100 kWh a quarter at 2d/kWh and the balance at 1·65d/kWh. This tariff will be available to any industrial consumer; (*b*) As an alternative for consumers whose demand is 20 kW or more, a maximum demand tariff with a sliding charge adjusted for lagging power factor and a kWh charge for all electricity supplied, subject to a coal price variation clause. The alternative tariff is designed to encourage improvement in load factor. The tariffs are expected to yield an additional 12 per cent over the present revenue from industrial consumers. While some consumers will find their charges reduced, others will pay more than the average percentage increase, but to avoid the possibility of any consumer being suddenly faced with a heavy increase in charges, no consumer in the year following the introduction of the new tariffs will have to pay more than 20 per cent above what he would have paid if the existing tariff had remained in operation. The Board have already introduced standard tariffs for domestic and farm supplies and are now giving consideration to the standardization of charges for commercial and public lighting supplies.

New Power Station

The British Electricity Authority have received the consent of the Minister of Fuel and Power to the establishment of a new 600,000 kW power station at Castle Donington, near Derby. The authorization covers the complete installation of the station which will comprise six 100,000 kW turbo-alternator sets, six boiler units each of an evaporative capacity of 830,000 lb of steam an hour, and four cooling towers each having a capacity of approximately 4½ million gallons of water an hour. The first set is planned to be in commission by the winter of 1955 and it is provisionally contemplated that the whole station will be running by 1960.

Maintenance of Domestic Appliances

A schedule of charges for maintaining electrical appliances was criticized as being much too high at a meeting of the South East Scotland Electricity Consultative Council on 5th November in Edinburgh. Mrs. Ure, Armadale, said that a household with an electric cooker, washing machine, kettle, and immersion heater would, under the scheme, have to pay 61s a year if they wished to have their apparatus maintained by the Board. Mr. J. C. Moule, chief commercial officer of the Board, pointed out that users of appliances were under no obligation to contract with the Board for their maintenance. Experience had shown that in some cases where there was a prospect of a heavy outlay on maintenance people would carry on using the appliance in a defective and perhaps dangerous condition; it was in order to prevent this that the Board was introducing

the maintenance service, which was really a kind of insurance scheme. The schedule of charges was based on past experience with equipment under the control of the Board.

Reservoir Hydro-Electric Plan

A £20,000 scheme for using the water of a new reservoir under construction at Upper Glendevon, Perthshire, for generating electricity, has been approved by Fife Water Supplies Committee. The county engineer, Mr. C. Huddleston, estimates that it should produce not less than 1,500,000 kWh a year. In a report to the Committee Mr. Huddleston stated that he had had informal talks on the matter with the Hydro-Electric Board. He understood that the Board would have no objection to the Fife County Council's developing the water power, and that the Board would be willing to purchase the energy developed if it were delivered into the Board's transmission line which was about to be constructed from Yetts of Muckhart along Glendevon. The average annual income would be not less than £2,000.

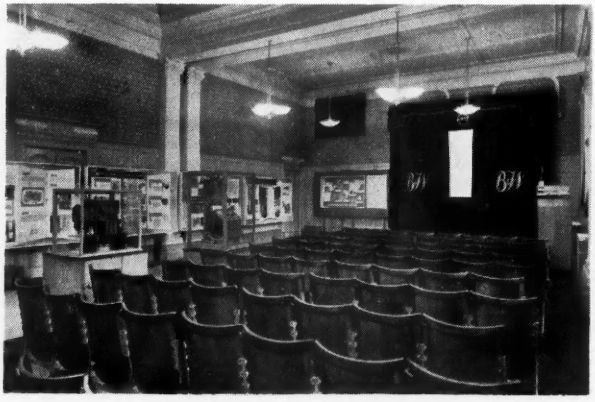
Boiler Plant Display

A PRIVATE exhibition hall and cinema has been equipped by Babcock & Wilcox, Ltd., at Salisbury Square House, Salisbury Square, London, E.C.4, to provide at a central point in London, and convenient to their head office in Farringdon Street, a "shop window" for the extensive range of steam-raising equipment which the company manufactures. The demonstration of modern boiler and auxiliary plant is difficult. Hence the company makes considerable use of sectionalized models and of films and other media, and these can be conveniently centralized in the new exhibition hall. The facilities of the hall will be available to the company's subsidiaries and it is planned to change the display from time to time to cover different aspects of the work of the Babcock & Wilcox organization.

The hall is fully equipped for the showing of 16 mm sound (or silent) films. Comfortable seating accommodation is provided for an audience of up to 80 people. The hall is attractively decorated in pastel shades of blue and grey, with the curtains and the upholstery of the cinema seats in wine red. The main hall is 60ft long by 30ft wide. It is equipped with a soundproofed projection box from which the whole of the hall lighting, dimming arrangements, curtain operation, etc., are controlled.

There is a display of models of modern power station and marine boilers and of an exhibition sequence illustrating and describing the major part played by the company in the development of the water-tube boiler, including copies of the original British patent of Babcock & Wilcox for their water-tube boiler, dated 1873, the early patent drawings, and photographs of George Babcock and Stephen Wilcox, and the original medallion presented to the company for its exhibit of a water-tube boiler at the Paris Exposition in 1889. Other sections of the display illustrate current production and research at the company's Renfrew works.

When the hall was opened last week a coloured film entitled "Steam for Power" was shown. Made by the company's American associate, the Babcock & Wilcox Co., it described the development of steam-raising equipment from the simple apparatus employed by Hero of Alexandria to the latest cyclone furnace. The manufacture of the component parts of many modern American installations was described and the theory of operation of each plant was explained in such a way as to be understandable to those who had never seen such equipment.



Babcock & Wilcox exhibition hall and cinema

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Tube Investments, Ltd., reports trading profits, subject to audit, after providing for depreciation, of £7,431,189 for the year to 4th August last, as compared with £6,024,839 for the preceding 53 weeks, and after adding other income, deducting £4,732,894 for taxation, and making other provisions, the amount available for the year is £2,979,162 (against £2,825,420). From this the following items are deducted :— Capital increase expenses £193,856; transfer to stock reserve of subsidiary companies, £250,000; retained by subsidiaries, £335,803; and transfer to general reserve £1,417,693. It is proposed to pay a final dividend on the ordinary stock of 12½ per cent actual, making 25 per cent for the year (unchanged). The directors state that production, turnover, exports and profits again reached new high records, but shortages of raw materials have been increasing in severity during the year and latterly output at a reduced level has been maintained by using up steel stocks. Since the end of the financial year the consumption of these has continued and until it is known that substantially greater steel supplies will soon be available the uncertainty of the outlook for the steel tube division in particular causes concern.

Falk, Stadelmann & Co., Ltd., report group profits for the year ended 31st March last of £564,695, as compared with £483,796 for the preceding year, to which is added investment income, etc., of £7,846 making £572,541. After deducting depreciation, £61,694, taxation, £229,085, and making other provisions, the net profit of the parent company is £99,764 (against £99,043), to which is added £63,778 brought in and £17,250 unrequired provision for subsidiary losses. Contingencies reserve receives £25,000, staff pensions £10,000, and cost of new capital issue £4,101. It is proposed to pay a final ordinary dividend of 5 per cent, making 15 per cent for the year, the final dividend being paid on increased capital. The distribution for the previous year was 15 per cent. The balance carried forward is £75,928.

In his circulated statement, Mr. H. Falk (chairman) says that their design and research staff are continually studying new methods of production, not only for the purpose of meeting increasing competition but also to evolve new appliances in which direction they have made definite progress. A considerable portion of their earnings have been derived from their export trade to which have to be added the increased profits of their overseas branches. In the current year sales continue to expand in both the home and overseas markets.

Illustrations of some of the ten principal works owned by the company appear in the report and accounts.

Heenan & Froude, Ltd., report a group profit for the year to 1st September last of £370,851, as compared with £327,358 for 1949-50. Taxation requires £229,884, and the group net profit, after deducting minority interests, is £140,943 (against £134,261), to which is added £54,420 brought in. It is proposed to pay a final ordinary dividend of 10 per cent, making 15 per cent for the year (same) on larger capital. The balance carried forward is £58,582.

At an extraordinary meeting to be held on 21st December proposals will be submitted to capitalize £42,640 15s out of capital reserves and to distribute to ordinary shareholders 170,563 ordinary shares of 5s each in the proportion of one new ordinary for every eleven existing shares held.

The Sun Electrical Co., Ltd., reports a profit for the year ended 30th April last of £44,249, as compared with £33,184 for the preceding year, after providing £62,709 for taxation. Reserve receives £15,000 and it is proposed to pay a dividend for the year of 15 per cent (against 10 per cent). The balance carried forward is £50,912 (against £34,050 brought in).

Strand Electric Holdings, Ltd., held its annual meeting on 5th November, Mr. J. D. H. Sheridan (chairman and joint managing director), presiding. In his circulated statement the chairman said that output during the year under review advanced by over 12½ per cent. Production had now started in the additional works space provided in the Vauxhall premises. The progress in the theatre lighting, stores, and general sections of their Sales Department had been satisfactory and in spite of lighting restrictions during the first quarter of 1951, satisfactory progress had been made in their Sign Department. Their field of activities in the Contracting Department was widening, but the year under

review had been somewhat less satisfactory. The current year, however, had started well. Implitico, Ltd., their wholly owned subsidiary, showed a satisfactory profit and preliminary figures of Beck & Pollitzer and Strand Electric, Ltd., were also satisfactory.

Aberdare Cables Africa, Ltd., reports a net profit for the year ended 30th June last of £109,282, as compared with £57,265 for the previous year. From this the following allocations have been made.—Reserve for metals fluctuation, £12,500; contract contingencies, £12,500; assets replacement, etc., £5,000; general reserve, £30,000. The dividend for the year is 10 per cent (against 6 per cent), and £11,832 is carried forward.

Cape Electric Tramways, Ltd., reports a net profit for the year to 30th June last of £90,462, as compared with £61,547 for the preceding year. It is proposed to pay a dividend for the year of 5 per cent (against 4 per cent).

The East African Power & Lighting Co., Ltd.—The lists for the issue of 1,000,000 ordinary shares of 20s each at Sh. 32.50 in Kenya and 32s 6d in the United Kingdom opened and closed on 6th November being heavily oversubscribed.

Oliver Pell Control, Ltd., reports a trading profit for the year ended 31st March last of £11,562, as compared with a loss of £7,712 in the preceding year, and a net profit of £2,305 (against a loss of £21,278), reducing the debit balance carried forward to £52,078.

New Companies

Mea'Dion Products, Ltd.—Registered 1st November. Capital £1,000. Manufacturers, importers and exporters of and wholesale and retail dealers in electrical and radio goods of all kinds, etc.. Directors : E. Meadows, G. Dion and Doris M. Buckeridge. Regd. office : Fulwood House, Fulwood Place, W.C.1.

William Storey & Partners, Ltd.—Registered 1st November. Capital £100. Plating engineers, radio, television and electrical engineers, etc. Directors : T. W. Porter and W. A. Storey. Regd. office : 391, Ewell Road, Surbiton, Surrey.

Disc Motor and Pump Co., Ltd.—Registered 2nd November. Capital £100. Manufacturers of and dealers in electric motors for the operation of bore-hole pumps and all machinery, appliances and apparatus connected with pumps, etc. Directors : N. Pensabene-Perez, E. J. Timberlake and K. W. Hogan. Regd. office : Bristol Road, Bridgwater, Som.

Aerotronics, Ltd.—Registered 7th November. Capital £1,000. Designers and manufacturers of and dealers in electronic equipment, aircraft, radio and radar communications equipment, etc. Directors : C. E. J. Rockall, Clare L. Kaylor and J. R. Mackay. Regd. office : Stable Works, 199a, Uxbridge Road, W.7.

Winding-up Petition

Electrical & Radio Installations (Ealing), Ltd.—A petition for the winding-up of this company has been presented to the High Court by the Commissioners of Inland Revenue and will be heard in London on 19th November. Any person intending to appear at the hearing of the petition must notify Mr. W. B. Blatch, Solicitor of Inland Revenue, Somerset House, Strand, London, W.C.2, by 17th November.

Liquidations

The Ely Valley Lighting Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. R. Graves, Midland Bank Chambers, 97, Bute Street, Cardiff.

Power Lines Construction Co., Ltd.—Winding up voluntarily. Liquidator, Mr. E F. Wilkins, 8, Queen Street, Cheapside, London, E.C.4. Particulars of claims to the liquidator by 15th December. This notice is purely formal; all debts have been or will be paid in full.

Lauray Electrical Co., Ltd.—Meetings of members and creditors on 20th December at the offices of Shindler & Co., 23-25, Eastcheap, London, E.C.3, to receive an account of the winding-up by the liquidator, Mr. C. Boulton.

Warrington Electric Cables, Ltd.—Meeting of members on 11th December at the offices of Langton and Macconnal, 7, Rumford Street, Liverpool, 2, to receive an account of the winding-up by the liquidator, Mr. C. D. Irving.

Bankruptcies

Haine & Co., 77, Westbourne Grove, London, W.2, electricians.—Receiving order made 2nd November on a creditor's petition.

C. F. Burns, High Street, Stalham, Norfolk, electrical and radio engineer.—Receiving order made 2nd November on debtor's own petition.

P. L. A. Eliot, 103, Denton Street, Carlisle, electrician and radio dealer.—Trustee, Mr. A. L. Medcalf, 14, Lowther Street, Carlisle. Official Receiver, released 30th October, 1951.

STOCKS and SHARES

KNOWLEDGE of the financial crisis with which the nation is now faced has naturally exercised a sobering effect upon Stock Exchange markets and business. Removal of the suspense which had previously prevailed is so much to the good, but the immediate outlook is still as obscure as ever and the financial position, domestic and international, is extremely difficult to assess. It is not surprising, therefore, to find Stock Exchange business is proceeding quietly and without marked activity in any department. Prices keep up tolerably well on the whole, but the changes since a week ago are mostly in the lower direction. The daily turnover of shares is distinctly lower than it was some weeks ago. The early part of the week was marked by a further fall in British Government stocks and other gilt-edged securities.

Electrical Equipment Shares

Prices of industrial shares began to look a little better as soon as the Government had fired its first shots in the campaign to restore financial stability. They have regained, nevertheless, only a little of their pre-Election air of what seems to have been misplaced optimism. Apart from the general gravity of the situation, and the practical effect which deflationary measures may exert on business activity and earnings, the industrial market has a particular concern of its own in the shape of the Excess Profits Tax to be detailed in January. Meanwhile, although not now at their worst, the substance of the recent fall since polling-day can be gauged by a drop of 3s 9d in A.E.I. to 90s; of 3s 6d in G.E.C. to 94s 6d; and of 4s 6d in English Electric to 67s 6d.

Falk, Stadelmann Dividend

The final dividend of 5 per cent declared a week ago by Falk, Stadelmann & Co. is payable on ordinary capital increased one-tenth by the issue of new shares in March; so that in maintaining the total distribution at 15 per cent, for the fifth time running, the company is making a slightly larger distribution. On this occasion, the final 5 per cent is given the firmer description of dividend, whereas formerly it has been declared as a bonus. Group trading profits are up by about 16 per cent, a result to which a good deal of credit is apparently due to the expansion of the company's export business. It means a net group surplus of about £120,000 after payment of dividends costing £66,000. Despite this year's capital issues the resources of the group still require careful handling, says the report, to deal with the financing of a larger volume of trade and stocks. The £1 shares have hardened to 49s 6d, at which they yield £6 1s 2d per cent.

British Electricity Stocks

It proved, in the event, that the heavy fall in gilt-edged prices which followed the Election result discounted fairly accurately the extent of the dearer money measures now introduced by the new Chancellor. The rise in Bank Rate was not unexpected, but, in trying to measure the prospects, it is recognized that the direction taken by Treasury policy is against gilt-edged prices. Since, however, its deflationary intention is to strengthen confidence in sterling, there is at the same time a pull in favour of the higher-yielding Government issues. Evidently the net outcome must be expected to rest in the balance until the present plans begin to show their effectiveness. Meanwhile, the two 3 per cent British Electricity stocks are a small fraction above the recent worst at 89½ for the 1968–73 issue, and 88¼ for the 1974–77. Transport issues are weak, the 3 per cents of 1878–88 falling back to 83.

Changes on the Week

Tube Investments went back to 6¼ on disappointment at the retention of the dividend at 25 per cent for the year, though the profits show a substantial increase over those of the previous year. Anglo-American Telegraph preferred stock is 3½ points down at 97½, in spite of the surprising rise in the " B " stock. Chloride, 67s 6d, are 2s 6d lower, and smaller falls have made British Vacuum 17s, Hoover, 31s 9d, Vactric, 8s 9d. E. K. Cole, 19s 6d, and Pye, 24s 6d, Cossor, 14s 9d, E.M.I, 22s, and Decca, 21s, are all a little easier. The other changes are mainly confined to a loss of 6d in each case. International Combustion hardened to 21s 3d, Enfield Cables to 35s 6d and Calcutta Trams to 26s 6d.

Six Hundred Per Cent Rise

A minor but interesting market feature is the remarkable rise which has taken place in Anglo-American Telegraph " B " stock. This is the issue which replaced the bulk of the company's deferred stock when the capital was re-organized a few months ago. From a price of about 1 per cent at that time, the stock rose with a jerk to about 8 per cent. The market confesses to mystification about the occurrence. Neither dividend nor voting rights are attached to the stock, which possesses only a claim to the assets of the company in the event of a winding up. No substantial reasons have appeared, either, to account for the continued activity in Telephone Properties 10s shares, which stand now at 35s 6d after changing hands up to 40s, easily the highest price that has ever been recorded.

NEXT WEEK'S EVENTS

Monday, 19th November

BIRMINGHAM.—Grand Hotel. Birmingham Electric Club. "The Status of Science in 1851," by Sir Henry Self.

CARDIFF.—At the South Wales Institute of Engineers, 6 p.m. I.E.E. Western Supply Group. "Economic Plant Sizes and Boiler-Set Groupings on the British Grid," by B. Donkin and P. H. Margen.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Light Electrical Engineering and the Mechanical Engineer," opened by T. E. Goldup.

NEWCASTLE-ON-TYNE.—King's College, 6.15 p.m. I.E.E. North Eastern Radio & Measurements Group. "An Electronic Process-Controller," by J. R. Boundy and S. A. Bergen.

READING.—George Hotel, 7 p.m. I.E.E. London Students' Section. District meeting. "Medical and Industrial Uses of Radio Frequency Energy," by H. Burton.

SHEFFIELD.—The University, Western Bank, 6.30 p.m. I.E.S. Sheffield Centre. "Home Lighting," by Miss Wardlaw.

Tuesday, 20th November

DERBY.—Electricity Service Centre. I.E.E. East Midland Centre. Informal lecture on "Diesel Locomotives," by A. P. Goodman.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. Four papers on "High Speed Digital Computers," by Prof. F. C. Williams, Dr. T. Kilburn, G. C. Tootill, G. E. Thomas, J. C. West and Dr. A. A. Robinson.

I.E.E. London Students' Section, 8.30 p.m. Visit to the Times Publishing Co., E.C.4.

Magnet House, Kingsway, W.C.2, 6.30 p.m. Association of Supervising Electrical Engineers. "High Frequency Electric Heating," by M. O'C. Horgan. (Joint meeting with the Institution of Engineers-in-Charge.)

At the Institution of Mechanical Engineers, Storey's Gate, S.W.1, 5.30 p.m. Institute of Fuel. "Automatic Control Systems for the Coal Feed of Gas Producers," by Dr. S. A. Burke and G. A. Sparham.

PORTSMOUTH.—B.E.A. Offices, 111, High Street, 8 p.m. A.S.E.E. Portsmouth Branch. "Diagnosis of Faults in Fluorescent Lighting Circuits," by A. G. Mitchell.

Wednesday, 21st November

COVENTRY.—G.E.C. Telephone Works, 7 p.m. I.E.E. South Midland Students' Section. "Electronic Control of Spot and Seam Welding Machines," by C. R. Bates.

LONDON.—I.E.E. London Students' Section, 2.30 p.m. Visit to Standard Telephones & Cables, Ltd., Valve Works, Footscray, Kent.

Waterloo Bridge House, S.E.1, 5 p.m. Institution of Post Office Electrical Engineers. Informal meeting, "Telecommunications in Aviation," by W. P. Nicol.

London School of Hygiene & Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. "Developments in High Frequency Transmitter Cables," by R. C. Mildner.

4, Grosvenor Gardens, S.W.1. Iron and Steel Institute. Autumn meeting (continued on 22nd November).

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. "Control Equipment," by G. T. Maycock.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Crystal Diodes," by R. W. Douglas and Dr. E. G. James. "Crystal Triodes," by T. R. Scott.

SALISBURY.—17, New Canal, 6.30 p.m. I.E.E. Southern Centre. Informal meeting. "Development and Maintenance of Rural Overhead Distribution Networks," by W. P. Orchard.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. Lecture on "Modern Developments in Atomic Energy," by Dr. T. E. Allibone.

Thursday, 22nd November

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilization Section. "Electrical Control of Dangerous Machinery and Processes: Part III—Remote Supervisory Control," by W. Fordham Cooper.

NORTHAMPTON.—E.P.E.A. Midland Technical Group, 7 p.m. "11 and 33 kV Overhead Line Construction," by N. G. Simpson.

Friday, 23rd November

LONDON.—Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. Institution of Mechanical Engineers. "The Control of Boilers Fired by Solid Fuels in Suspension," by Ll. Young.

39, Victoria Street, S.W.1, 6.30 p.m. Junior Institution of Engineers. Annual general meeting, followed by the annual general meeting of the contributors to the Benevolent Fund of the J.I.E.

Savoy Hotel, W.C.2, 6.30 for 7 p.m. Association of Electrical Machinery Trades. Annual dinner-dance.

NEWCASTLE-ON-TYNE.—King's College, 6.30 p.m. I.E.E. North Eastern Students' Section. "Experiences on an Australian Distribution System," by E. G. Williams.

STONE.—Crown Hotel, 8 p.m. I.E.E. North Staffordshire Sub-Centre. Annual dance.

Saturday, 24th November

BIRMINGHAM.—Grand Hotel. I.E.E. South Midland Students' Section. Joint annual dance with Graduates' Section of the I.Mech.E.

LONDON.—I.E.E. London Students' Section, 10 a.m. Visit to E.M.I. Studios, Ltd. (repeat visit).

Power Convention Proceedings

DELEGATES to this year's British Electrical Power Convention at Brighton have now received the printed and bound "proceedings" including all the papers and discussions, a report of the speeches at the annual dinner, an account of the annual general meeting, and a full list of delegates. A few copies of the proceedings are available from the secretary, Mr. J. W. Simpson, O.B.E., 16, Stratford Place, London, W.1, price 12s 6d each.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) will be obtainable after 26th December from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1944

12868. Sperry Gyroscope Co., Inc., and Rollinson, E. W. —Production of ultra-high-frequency energy of desired frequency by electron-discharge apparatus. 4th December, 1942. Divided out of 648881. Convention date not granted. (663611.)

1945

4523. British Thomson-Houston Co., Ltd.—Pulse generating circuits. 22nd February, 1945. (663612.)

1946

1810. Burndept, Ltd., Lewis, R. W., and Rowe, L. R. —Manufacture of electric dry batteries. 22nd October, 1947. (663811.)

1204. Compagnie Générale d'Electricité.—Automatic sorting system applicable to telephony or telegraphy. 11th January, 1946. (663715.)

7890. Marconi's Wireless Telegraph Co., Ltd.—Electrical pulse generator circuit arrangements. 13th March, 1946. (663911.)

17290. Philips Electrical, Ltd.—Circuits for demodulating modulated-pulse signals. 6th January, 1946. (663716.)

21497. Akt.-Ges. Brown, Boveri & Cie.—Apparatus for the acceleration of electrons and ions. 18th July, 1946. (663816.)

25365. Hazeltine Corporation.—Wave-signal communication system. 24th August, 1946. (663709.)

37289. British Thomson-Houston Co., Ltd., Welch, D. F., and Grieve, A.—Oscillograph apparatus. 3rd June, 1948. (663818.)

1947

5925. Thomas (Engineers), Ltd., B., and Thomas, A. B.—Electric heaters. 27th February, 1948. (663819.)

6390. Sperry Gyroscope Co., Inc.—Apparatus for providing an output signal in dependence on displacement of a movable controlling member. 6th March, 1947. (663913.)

10020. British Thomson-Houston Co., Ltd., and Keitley, R.—Coupling system for ultra-high-frequency transmission lines. 22nd September, 1948. (663820.)

15136. Trignitron Aktiebolag.—Electronic switching circuits. 9th June, 1947. (663822.)

21090. Sylvania Electric Products, Inc.—Constant starting voltage discharge lamp. 1st August, 1947. (663825.)

22224. Philips Electrical, Ltd.—Velocity-modulation systems and discharge tubes therefor. 11th August, 1947. Addition to 645937. (663830.)

26414. Philips Electrical, Ltd., Bailey, C. E. G., and Paul, D. H.—Electrical frequency and phase-modulation signalling systems. 30th September, 1948. (663619.)

28430. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Apparatus for detecting radiant energy. 24th October, 1947. (663727.)

28840. Compagnie Générale de Telegraphie sans Fil.—Travelling wave amplifying valves. 29th October, 1947. (663728.)

29475. Barasch, H. P.—Electron-discharge devices. 18th June, 1948. (663730.)

31521. Automatic Telephone & Electric Co., Ltd., and Smith, S. R.—Wire-wound electrical components. 13th November, 1948. (663520.)

32803/5. Western Electric Co., Inc.—Electron-discharge apparatus. 12th December, 1947. Addition to 637820. (663837/9.)

1948

304. Sperry Gyroscope Co., Inc.—Resonant-space resonators and ultra-high-frequency electron discharge tubes incorporating them. 5th January, 1948. (663845.)

1026. Murphy Radio, Ltd., and Balcan, J. H.—Loudspeakers. 17th June, 1949. (663734.)

2265. Bailey Meters & Controls, Ltd.—Electric convertors. 26th January, 1948. (663521.)

4251. Rosenqvist, G.—Manufacture by electrodeposition. 13th February, 1948. Convention date not granted. (663850.)

5095. Western Electric Co., Inc.—Apparatus for modifying electric signals in accordance with a desired function. 20th February, 1948. (663851.)

5314. Radio Corporation of America.—Leak detector for evacuated systems and devices. 23rd February, 1948. (663852.)

6123. British Thomson-Houston Co., Ltd.—Television transmitting and receiving systems. 27th February, 1948. (663624.)

6187. Sylvania Electric Products, Inc.—Electric discharge tube. 27th February, 1948. (663854.)

6699. Philips Electrical, Ltd.—Amplifier circuits for use in image transmission. 3rd March, 1948. (663857.)

6926. British Thomson-Houston Co., Ltd.—Pole shaders for electromagnets. 5th March, 1948. (663737.)

7344. Debenham, W. R., and Shenton, J. C.—Electrical ignition systems. 4th September, 1948. Cognate applications 14389, 27th May, 1948, and 18033, 5th July, 1948. (663527.)

7494. Compagnie Générale de Telegraphie sans Fil.—Methods and apparatus for modulating ultra-short waves. 11th March, 1948. (663625.)

9025. Debenham, W. R., and Shenton, J. C.—Electrical ignition systems. 30th April, 1949. Cognate applications 9849, 8th April, 1948, 14390, 27th May, 1948, and 18034, 5th July, 1948. (663528.)

9750. British Thomson-Houston Co., Ltd.—Preparation of organo-silicon halides. 7th April, 1948. (663740.)

9887. British Thomson-Houston Co., Ltd., Walker, C. H., and Large, F. E.—Circuit arrangements for operating electric discharge lamps. 8th April, 1949. (663530.)

11542. General Electric Co., Ltd., and Sherwen, J. W. —Vibrating conveyors and the like. 26th April, 1949. (663627.)

11765. Radio Corporation of America.—Multiple television projector. 29th April, 1948. (663628.)

12221. Director of the Office of Technical Services, Department of Commerce.—Resistor and method of making the same. 4th May, 1948. (663629.)

14698. Philips Electrical, Ltd.—Carrier-wave telegraph transmitters. 31st May, 1948. (663535.)

16230. British Thomson-Houston Co., Ltd.—Electromagnetic structures. 16th June, 1948. (663753.)

18156. British Thomson-Houston Co., Ltd.—Control means for electric blankets. 6th July, 1948. (663632.)

19555. Meili, E.—Remote control switch devices. 21st July, 1948. (663633.)

21357. Standard Telephones & Cables, Ltd.—Oxide coated cathodes for electron-discharge devices. 13th August, 1948. (663635.)

21879. Compagnie de Produits Chimiques et Electro-Metallurgiques Alais, Froges & Camargue.—Construction of the lower part of the crucible of fused electrolysis cells. 19th August, 1948. (663763.)

23183. Thomason, J. G.—Thermionic valve amplifiers. 29th September, 1949. (663544.)

23194. Siemens-Schuckert (Gt. Britain), Ltd., and Panzerbieter, K. H.—Resistance welding transferences and welding machines. 2nd September, 1948. (663765.)

23439. Williams & Sons, Ltd., S., and Durston, D. S.—Electrical control circuits. 24th August, 1949. (663767.)

24410. Standard Telephones & Cables, Ltd.—Ultra-high-frequency electron-discharge apparatus. 17th September, 1948. (663869.)

24671. Brush Development Co.—Electro-transducer and method of making same. 21st September, 1948. (663546.)

24672. Brush Development Co.—Multi-plate piezo-electric crystal transducers. 21st September, 1948. (663547.)

24815. Bendix Aviation Corporation.—Electrical circuit testing apparatus. 22nd September, 1948. Addition to 661087. (663548.)

24908. Western Electric Co., Inc.—Magnetic recording devices. 23rd September, 1948. (663772.)

25697. Seismograph Service Corporation.—Radio position determining system. 1st October, 1948. (663775.)

26430. Allmanna Svenska Elektriska Aktiebolaget.—Circuits for the control of luminous electric discharge tubes. 11th October, 1948. (663549.)

26546. Metropolitan-Vickers Electrical Co., Ltd., Ghalib, S. A., Kelsall, R. H., and Howbrook, E.—Electrical control circuits. 12th July, 1949. (663776.)

26651. Igranic Electric Co., Ltd., and Field, J. A.—Electric circuit networks for use with a three-phase current supply. 13th October, 1949. (663642.)

29092. Western Electric Co., Inc.—Electric pulse signalling systems. 9th November, 1948. (663872.)

29768. Campbell, G. A. A.—Electrical plug-and-socket connectors. 15th November, 1949. Cognate application 32191, 13th December, 1948. (663920.)

30330. Marconi's Wireless Telegraph Co., Ltd., and Parker-Smith, N. N.—Demodulating circuit arrangements. 28th July, 1949. (663874.)

30550. Marconi's Wireless Telegraph Co., Ltd., and Jolliffe, S. A. W.—Indicating devices. 29th September, 1949. (663875.)

30572. Pye, Ltd., Cope, J. E., and Germany, L. W.—Arrangements for stabilizing the scanning waveform used for the magnetic deflection of cathode-ray tubes and the like. 21st November, 1949. (663779.)

31369. British Thomson-Houston Co., Ltd.—Clamping device for magnetic cores. 3rd December, 1948. (663569.)

31380. General Electric Co., Ltd.—Multi-channel electric pulse signalling systems. 3rd January, 1950. (663782.)

31523. British Thomson-Houston Co., Ltd.—Electrodes for electric discharge devices. 6th December, 1948. (663878.)

31745. Morris, Ltd., B. O., and Rosenthal, E. W. S.—Electrically driven grinding, polishing, and like machines. 8th December, 1949. (663570.)

32952. Western Electric Co., Inc.—Electric circuit arrangements including frequency-dividing circuits. 21st December, 1948. (663921.)

33136. General Electric Co., Ltd., and Francis, V. J.—Electric discharge lamps. 19th January, 1950. (663787.)

1949

556. Metropolitan-Vickers Electrical Co., Ltd.—Terminal arrangements for helically-coiled electric heating elements. 6th January, 1950. (663649.)

1542. Marconi's Wireless Telegraph Co., Ltd., and Mortley, W. S.—Frequency dividers. 8th December, 1949. (663657.)

5029. Parsons, Ltd., C. H., and Handley, G. B.—Lever-operated electric switches. 23rd February, 1950. (663923.)

5201. Radio Corporation of America.—Directive antenna system. 25th February, 1949. (663924.)

5234. General Electric Co., Ltd., McDonald, J. J., and Turner, H. C.—Dry-plate electric rectifiers and methods of manufacture therefor. 22nd February, 1950. (663925.)

5762. Dixon, M. G. (Robertshaw-Fulton Controls Co.).—Electric devices for igniting fluid-fuel. 2nd March, 1949. (663663.)

5898. Marconi's Wireless Telegraph Co., Ltd., Beanland, C. P., and Rickaby, F. I.—Modulated carrier-wave radio receiving systems. 11th October, 1949. (663664.)

5932. Standard Telephones & Cables, Ltd., and Odell, A. D.—Electrical circuits employing static electrical switches. 4th March, 1949. (663574.)

8208. Siemens Bros. & Co., Ltd.—Telephone switchboards. 24th March, 1950. (663665.)

9503. Stevens, A. H. (Electric Storage Battery Co.).—Storage batteries. 7th April, 1949. (663794.)

9773. British Thomson-Houston Co., Ltd.—Pressure-change amplifying devices suitable for use in hydraulic governing systems for turbines. 11th April, 1949. (663935.)

10335. Standard Telephones & Cables, Ltd., Jacobsen, B. B., and Roe, F. O.—Negative feedback amplifiers. 19th April, 1949. (663583.)

10346. Philips Electrical, Ltd.—Ultra-high-frequency thermionic amplifiers. 19th April, 1949. (663667.)

10796. Cinch Manufacturing Corporation.—Socket units for thermionic valves and other electrical components having projecting prongs and contacts for such socket units. 22nd April, 1949. (663938.)

11319. Philco Corporation.—Circuits for generating triangular pulses. 28th April, 1949. (663883.)

11570. Dunlop Rubber Co., Ltd., Bulgin, D., and Owen, G. E.—Electrostatic spray coating method. 14th April, 1950. (663885.)

12383. Marconi's Wireless Telegraph Co., Ltd.—Waveguides. 27th April, 1950. (663889.)

12706. British Thomson-Houston Co., Ltd.—Dish-washing apparatus. 12th May, 1949. (663586.)

13157. La Mont International Association, Ltd., and Bauer, F. W.—Forced recirculation tubular steam generators. 17th May, 1949. (663892.)

14025. General Electric Co., Ltd., Garthwaite, F. N., and Wilson, E.—Telecommunication apparatus and the like. 16th May, 1950. (663895.)

14434. Standard Telephones & Cables, Ltd., and Treadwell, C. G.—Signalling over electric pulse communication systems. 30th May, 1949. (663587.)

14538. Westinghouse Brake & Signal Co., Ltd., and Walker, A. H. B.—Methods of suppressing arcing at contacts breaking an inductive circuit. 2nd May, 1950. (663898.)

16298. Ateliers de Constructions Electriques de Charleroi.—Thermionic speed-regulating device for electric motors. 20th June, 1949. (663673.)

16792. Standard Telephones & Cables, Ltd., and Williams, O. G.—Switching systems. 24th June, 1949. (663588.)

27727. Landis & Gyr Soc. Anon.—Methods of manufacture of connectors for carrying electric current through walls or partitions. 28th October, 1949. (663684.)

28249. Standard Telephones & Cables, Ltd.—Reciprocatory flat switch operated by transforming a rotary movement into a reciprocating movement. 4th November, 1949. (663686.)

30765. Edison, Inc., T. A.—Bezel lock for electric safety lamps. 30th November, 1949. (663692.)

32137. First Industrial Corporation.—Separable electrical connectors. 14th December, 1949. (663699.)

1950

9383. British Thomson-Houston Co., Ltd., Walker, C. H., and Large, F. E.—Glow discharge thermal switches and operating circuits for electric discharge lamps employing same. 8th April, 1949. Divided out of 663590. (663608.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—SYDNEY.—6th December. County Council. Protective relays for substations. (C.R.E. (I.B.) 74874/51. Ten/3707.)* 13th December. Supply of 33 kV neutral earthing resistors. (C.R.E. (I.B.) 74872/51. Ten/3208.)* Supply of protective relays for use on 132 kV and 66 kV systems. (C.R.E. (I.B.) 74873/51. Ten/3206.)*

NEWCASTLE WEST (N.S.W.).—12th December. Hunter District Water Board. Electrically driven pumping plant for boosting stations at Sandgate. (C.R.E. (I.B.) 74678/51. Ten/3202.)* Thirty-eight electrically driven bore-hole pumps. (C.R.E. (I.B.) 74877/51. Ten/3200.)* Additional electrically driven pumping plant at Tomago. (C.R.E. (I.B.) 74876/51. Ten/3204.)* Electrically driven pumping plants for bore-hole boosting stations at Tomago. (C.R.E. (I.B.) 74878/51. Ten/3203.)*

Belfast.—26th November. Northern Ireland Trust. Electrical work required in connection with 166 houses at Hilden. Offices of the Trust, 12, Hope Street.

Dewsbury.—26th November. Town Council. Electrical installation works in connection with new secondary modern school at Bank Top. Borough architect, Town Hall.

Durham.—County Council. Electrical installation at Spennymoor new grammar technical school. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. Supply of 350 yd of 132 kV power cables. (See this issue.)

Luxembourg.—1st December. Department of Bridges and Roads, Ministry of Transport. Transformer plant at Luxembourg Air Port. (C.R.E. (I.B.) 73881/51. Ten/3174.)*

Nottinghamshire.—County Council. Firms wishing to have their names included in a schedule of contractors from whom tenders will be invited for building works, including heating and hot water installations and electrical installations should submit their names by 28th November. (See this issue.)

Stourbridge.—1st January. Main Drainage Board. Three electrically operated centrifugal pumps, including the supply of electric motors, switchgear, wiring, etc., for Enville Street Pumping Station. G. P. Deeley, engineer to the Board, 13, Church Street.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

ORDERS PLACED

Dagenham.—Borough Council. Electrical installations in houses on Heath Park estate (£1,906).—Evans & Shea, Ltd.

Liverpool.—Markets Committee. Recommended. Renewal of electrical installation at St. John's Market (£6,214).—Engineering Service Installations, Ltd.

Housing Committee. Recommended. Provision of up to 145 refrigerators as required for the Quarry Green dwellings at Kirkby (£39 each).—Electrolux, Ltd.

London.—L.C.C. Construction and maintenance of 100 eight-person electric passenger lifts at the Council's estates.—Express Lift Co., Ltd.

Electrical installations at Winton County Primary School, N.1, and Holmes Road School.—Buchanan & Curwen, Ltd.

Electrical installation at Mansford Street County Secondary School, E.2.—H. M. Horton, Ltd.

Newcastle-on-Tyne.—City Council. Electrical repairs to Council houses over a period of six months.—Bernard Berrie (Newcastle), Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bedlington (Northumberland).—Houses (160) for U.D.C.; A. S. Dennis, surveyor, U.D.C. offices, Bedlington.

Birmingham. — Completion of new St. Martin's toll market, underground car park, etc., Edgbaston Street (£134,250); H. J. Manzoni, city engineer, Civic Centre.

Boston.—Extensions to factory, Marsh Lane; Guest Industries, Ltd., Spalding.

Clayton-le-Moors.—Further 40 houses at Field Bottoms site; U.D.C. surveyor.

Derby.—E.C. junior and infants' school, Mackworth estate; city architect.

Dover.—Houses (92), Buckland Valley estate, and 32 flats, Durham Hill; borough engineer.

Erith.—Houses (48), Matfield Road; borough surveyor, Town Hall.

Gosport.—Rebuilding police station, court house, offices, etc., South Street; county architect, The Castle, Winchester.

Ilford.—Shops (14) and flats, Cranbrook Road; A. J. Fowles, architect, 7, Burlescombe Road, Thorpe Bay.

Block of flats, Gaysham Hall site; borough engineer.

Kidderminster.—Divisional police station, police houses, etc., Blakebrook; L. C. Lomas, county architect, 14, Castle Street, Worcester.

Knutsford.—Houses (40), Warren Avenue estate; Kemps (Contractors), Ltd., 54, The Downs, Altrincham.

Lancashire.—Schools programme, 1952-53.—Great Crosby R.C. Secondary Modern (£129,640), Prescot & Huyton Girls' Grammar (£230,224), Kirkby South R.C., phase 1 (£49,280), Penketh County new infants' dept. (£31,400), Golborne Culcheth County (£90,140), Golborne Secondary Modern (£179,020), Whitefield Higher Lane Secondary Modern (£103,170), Middleton Bowlee County, phase 2 (£43,120), Droylsden Littlemoss Secondary Modern for Boys (£179,020) and Stretford St. Hildas C.E. (£43,120); county architect, Preston.

London.—CITY.—Office block, Guildhall Precincts; Sir Giles Gilbert Scott, architect, 3, Field Court, Gray's Inn, W.C.1.

LAMBETH.—Houses (103), Studley Road; M. J. Gleeson, Ltd., builders, London Road, North Cheam.

NEW CROSS.—Shops and maisonnettes with block of 28 flats, New Cross Road; Henry Kent, Ltd., builders, 31, Beacon Road, S.E.13.

PADDINGTON.—Flats (208), Eastbourne Terrace; R. A. Jensen, architect, 2, Howley Place, W.2.

WOOLWICH.—Dwellings (66), Rectory Place site, and 18 at St. Mary Street site; borough engineer.

Manchester.—Factory at Western Road, Baguley, for Aldhouse Milnes, Ltd.; T. Campion & Sons, Ltd., Ardwick, Manchester.

Market Drayton.—Houses (28), Dalelands estate, for U.D.C.; J. A. Harvey, Ltd., Smithfield Road.

Mitcham.—Flats (117), Glebe estate; borough engineer.

Newcastle-on-Tyne.—Houses for the City Council on 212 acres of land at Kenton; city architect, 18, Cloth Market, Newcastle.

Northumberland.—School building programme for next year includes Newburn County Secondary School and Morpeth County Primary School. County architect, County Hall, Newcastle-on-Tyne.

Nottinghamshire. — Primary school at Greenwood Drive, Kirkby-in-Ashfield; Greenwoods (Mansfield), Ltd., 2, Wood Street, Mansfield.

Oldham.—Occupational centre for mental defectives, Cardwell Street; Heywood & Ogden, architects, 12, Clegg Street, Oldham.

Infants' school at Fitton Hill estate; Hills (West Bromwich), Ltd.

Shops, maisonnettes and garages, Limeside estate; Cameron & Middleton, surveyors, 32, Deansgate, Manchester, 3.

Orrell.—Houses (24), Kit Green site, for U.D.C.; Rylance & Sons, St. James' Road.

Otley.—Houses (36), Weston Lane estate; U.D.C. surveyor.

Oxford.—Power house, administrative block, three pump houses, etc., in connection with sewage disposal works; city engineer, Town Hall.

Plymouth.—Secondary modern school, Burleigh Lane, Peverell; city architect.

Runcorn.—Flats (36), Town Hall estate; W. E. Jones (Contractors), Ltd. Lewin Street, Middlewich.

Sedgley.—Flats (24), Highgate and Hill Street, houses (52) at Moden Hill and houses (28) at The Firs and The Quarries; U.D.C. surveyor.

Skelmersdale.—Houses (18) at Windrows Farm site for U.D.C.; James Gee, 43, Worsley Street, Pemberton.

Stafford.—Conversions at premises, Wheaton Aston Camp, to provide dwellings for 166 families, for R.D.C.; Warkin, Willis & Cooper, architects, Burslem, near Stoke-on-Trent.

Startforth.—Houses (12) at Mickleton for R.D.C.; H. B. Richardson, architect, 3, Skinnergate, Darlington.

Stoke-on-Trent.—1952-53 schools programme: College of Ceramics and Pottery, development of North Staffs Technical College, Blurton County Secondary School, Blurton Newstead County Primary Infants', Ubberley Hall Estate Infants' and extensions at Horton Lodge School for Delicate Children. City architect.

Sunderland.—Factory at Pallion for making jet engines; Bristol Aircraft Co., Ltd., Bristol.

Surrey.—Extensions to Secondary School, Egham (£59,230), county primary school at Ash (£44,505) and county primary school at Ashtead (first section to cost £30,870); county architect, Kingston-on-Thames.

Tipton.—Flats (28), Factory Road; borough surveyor.

Twickenham.—Dwellings (51), Townfield Road; borough engineer.

Tynemouth.—Factory additions for the North Shields Fish Guano & Oil Co., Ltd.; Tasker & Child, architects, Trinity Buildings, New Bridge Street, Newcastle-on-Tyne.

Walsall.—Houses (33), Blackenhall Heath site; United Construction (Walsall), Ltd.

Warrington.—Houses (58), Wilderspool Crossings scheme; borough surveyor, Council Offices, Museum Street.

West Bromwich.—Showrooms, offices and stores, Walsall Road; Riley & Davies, 24, Wilbraham Road, Walsall.

Wigan.—Dwellings (175), Smethurst Lane; borough surveyor.

Willesden.—Boiler house and diesel generator building; Bee Bee Biscuits, Ltd., Sunya House, Scrubs Lane, N.W.10.

Worcestershire.—Stage 1 of Stourport Secondary Modern School (£96,127); Thos. Vale & Sons, Ltd., Lombard Street, Stourport.

Worksop. — Extensions to Town Hall (£60,000); borough surveyor, Park House.

Worthing.—Houses (20), Mardale Road; F. Kenton, builder, 61, Loxwood Avenue.

New workshops; W. J. Poland & Son, Ltd., 148, Montague Street.

Wrexham.—Dwellings (301), Southern area of Queen's Park estate; J. M. Davies, borough surveyor, 31, Chester Street.